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The Union Bridge Company's plan for crossing the Hudson River at New York will probably be accepted by the New York & New Jersey Bridge Co. for presentation to the Secretary of War. This plan must be filed in the War Department by June 7, and the company has then one year in which to complete and file details. The plan submitted calls for a suspension bridge of a clear span of 3,110 ft. It will have two immense rigid trusses, with curved top chord, hinged at the center and at the abutments, with a maximum truss depth of 200 ft. The main piers would be built of steel and would rise to a height of 587 ft. above high-water, with granite foundations extending about 122 ft. deep to rock. The clearance beneath the bridge would be 150 ft. The bridge would be wide enough for six tracks, and the cables will be fixed to the tops of the main towers, instead of being placed in saddles. All details are proportioned for high-speed railway trains. The plan includes a guarantee from the Union Bridge Company that the cost of erecting the bridge shall not exceed $25,000,000. The New York end of the bridge is located between 68th and 69th Sts., and the New York approach will be made of one 400-ft. span, extending to the bulkhead line, and one 575-ft. span crossing the tracks of the New York Central Railway. From the New York anchorage eastward the structure would occupy a space 100 ft. wide on the north side of 68th St. The New Jersey approach would be made of short deck spans. The two stiffening trusses mentioned would be spaced 125 ft. apart, and would be pin-connected, but the joints would be riveted after erection is complete to provide for reversal of strains. The twelve cables supporting the bridge would be two on each side of each truss and four in the center, dividing the cross floorbeams into three equal lengths. Each cabl ewould be 23 ins. in diameter, and the wire in these would have an ultimate resistance of 180,000 lbs. per sq. in. The six tracks on a level are designed to carry 3,000 lbs. per lin. ft., with an excess for engine loading.

The Canada & Michigan Tunnel & Bridge Co. has had its charter approved by the Canadian Parliament and is seeking authority from the U. S. Government at Washington for the construction of a bridge at Detroit. The plan approved by the Canadian railway committee calls for a cantilever bridge with a channel span of 1,000 ft. and a drwa at its center. The bridge would have a clear height of 45 ft. above the water surface. This draw would be left open, except on the passage of trains, during the season of navigation. The marine interests are opposing the project.

A bill for a bridge across the Niagara River at Buffalo, N. Y., is in the hands of the Mayor of that city for approval. The bill would give to Alonzo C. Mather the right to erect a bridge for the purpose of developing water power by attaching wheels to the bridge structure. The bridge would also be fitted for the passage of passengers and vehicles on payment of toll. There is some suspicion that this scheme covers a project for a railway bridge in the interest of the Lehigh Valley Ry.

A new East River bridge has been authorized by the Legislature and approved by the Mayors of New York and Brooklyn. Mayor Schieren, of the latter city, has named as his three bridge commissioners, Col. Andrew D. Baird, Henry Batterman and James A. Sperry. They will receive salaries of $3,000 per annum. The New York appointments are not yet announced. No plans are yet made public, though those prepared in 1892 by Mr. George B. Cornell, for the East River Bridge Co., contemplated a suspension bridge very similar to the Brooklyn bridge. The new bridge commission, which is to serve until the completion of the work, will probably organize some time this month.

The speed of the American Line steamship "St. Louis," on her recent contractor's trial trip, is yet a matter of speculation. No official report has been published, but it is rumored that she steamed at the rate of 22.75 knots for two consecutive hours. If this is true, and if this speed can be maintained, she is the fastest merchant vessel afloat by .65 knot. The "Lucania," on her recent record-breaking trip, averaged only 21.1 knots for the voyage. It will be safer, however, to await the records of a complete Atlantic trip, and one made after her machinery is well broken in.

A fast newspaper train has been put on by the Lake Shore & Michigan Southern Ry., to run between Chicago, Ill., and Buffalo, N. Y. The train leaves Chicago at 2.45 a. m., reaching Toledo, 244 miles, at 9 a. m.; Cleveland, O., 357 miles, at noon; and Buffalo, N. Y., 540 miles, at 5.40 p. m., or 15 hours for the entire run of 540 miles, giving an average speed of 36 miles per hour, including all stops.

The most serious railway accident of the week was the derailment of a wrecking train at McCook, Neb., on the Burlington & Missouri R. R., June 2. The train was on its way to repair a washout when it ran into another washout which had not been reported. Three men were killed, and another was seriously injured. ——A rear collision of two extra freight trains occurred June 2 between Harrison and Rye, N. Y., on the New York, New Haven & Hartford R. R. The first train had passed the Harrison block station and then stopped for the purpose of cooling a hot box. The rear brakeman, who had gone back to flag, was then called in, but the train had hardly started when a coupling in the middle of the train parted, and the rear section remained standing, while the forward section ran a short distance ahead before the mishap was discovered and the engine stopped. The brakeman at once ran back to flag the following freight train, but had not gone far when the train came up. The engine and about twenty cars were wrecked, the debris blocking all the tracks. One man was injured. The operator at Harrison admits having given the second train a clear signal, but says the operator at Rye had notified him that the first train had passed off the block, which the latter denies.

There have been 103 persons killed on the electric railways of Philadelphia, Pa., during the 17 months ending May 31.

An electric car at Syracuse, N. Y., jumped the track near a bridge and rolled down a 20-ft. bank into a muddy bottom. Nobody was killed, but nearly 20 persons were more or less injured. The track is laid with 80-lb. girder rails and is said to have been found in proper condition the point of derailment.

A dam at Curtis Lake, Neb., which is utilized as a railway embankment, gave way June 2 owing to the sudden rush of water caused by a heavy rainstorm in the mountains. The breach is said to be 100 ft. long and 25 ft. deep. Great damage to property has been done by the flood down the valley.

The Pacific Mail steamer "Colima" was wrecked on the Pacific coast of Mexico, between Manzanilla and Acapulco, on May 27, while on her way from San Francisco to Panama, and of 150 persons only about 20 were saved. The ship was making for a bay for shelter from a hurricane when she struck on a reef and soon went down. The accident is said to have been largely due to the carrying of a heavy deck cargo of timber, which made the ship unseaworthy in heavy weather. The "Colima" was built by John Roach at Chester, Pa., in 1873, and was 312 ft. long, 40 ft. beam, and 29 ft. deep, with five bulkheads. The compound engines were of 1,100 HP., driving a single screw, and the speed was about 11½ knots.

The French steamer "Dom Pedro," of 3,000 tons, on her way from Havre to Buenos Ayres, was wrecked near Carril, on the Spanish coast, about May 27. The vessel struck on a reef and went down, and it is stated that the boilers exploded as the ship sank. Of 130 persons on board, only about 35 or 40 were saved.

A bridge carrying the New York, Pennsylvania & Ohio R. R. over the Shenango River, at Shenango, Pa., was wrecked by a rear collision June 3, the second section of a parted train colliding with the first section, which was standing on the bridge. Seven cars went down.

A crossing collision occurred May 26 on the Pittsburg & Western R. R. near Youngstown, O., at a grade crossing of the track of the Union Iron & Steel Co. A N. Y., P. & O. R. R. switch engine with 12 cars on the mill track struck the engine of a fast freight train on the P. & W. R. R. track. Both engines and several cars were derailed and smashed.

The New York Rapid Transit Commission received on June 4 a report from Chief Engineer William B. Parsons, covering details of operation. Mr. Parsons recommended electricity as motive power, generated at a central station, where coal could be readily secured, and conveyed by solid conductors, placed between the rails, to motors located under one of the regular cars, acting as a motor car. This is the system already tested on the Intramural railway, and by which the new West End elevated railway in Chicago and the Liverpool elevated railway are operated. He recommends, for local trains, two, or at most three, cars, moving at half-minute intervals, insuring short stops at stations. For express trains five to six cars would be used, with stations 1½ miles apart. He also gave a list of station locations from the Battery to 185th St., for local and express service. A resolution was offered, to be acted upon at the next meeting, calling for the presentation of detailed plans for construction and operation not later than the last Tuesday in September next. Mr. Parsons would be authorized to consult with experts, and to confer with firms of contractors desiring to bid upon the work of construction.

The Bonta brake and fender for electric cars were tried recently on a car of the North Hudson Ry., at Jersey City, N. J., of which road Mr. A. K. Bonta is the electrician. When the current is shut off the forward revolution of the wheels is utilized to generate electricity, which is used for braking purposes. The fender is a padded frame, with bamboo "brushes" reaching nearly to the ground, and when the brake is applied the fender is dropped until the brushes are in contact with the ground.

The Siberian Railway Committee, says a St. Petersburg rumor, is considering the advisability of a more southern line for the eastern end of the route. The Russian press advocates a route through Manchuria by arrangement with the Chinese emperor, who would continue in possession of all present territory. The rumor evidently outlines the wishes of Russia in the matter of securing a more southern outlet for the Trans-Siberian railway; and she will build across Manchuria—if she can—by any diplomatic arrangement effected under pressure.

Jersey City is now to make the fourth attempt within three years to secure a new water supply. The Boards of Street and Water Commissioners and of Finance have adopted the specifications recently recommended by Mayor Wanser, and it is understood that bids will be received on July 1. The specifications call for a supply of 50,000,000 gallons a day, delivered by gravity to the high service reservoir, 210 ft. above mean high tide, and storage to the amount of 5,000,000,000 gallons. Parties putting in formal bids under the specifications, including a certified check for $100,000, "will be allowed to offer as many supplemental propositions and attach them to their bids as they may desire, in which they can offer for the consideration of the Board a new supply of water upon such terms, conditions and places as the bidder may propose." Further information may be obtained from Mr. Geo. T. Banton, Clerk of the Board of Street and Water Commissioners of Jersey City.

The tubular small-arms projectile of Kruka and Hebler has failed in a test with the U. S. service bullet at Frankford Arsenal. This bullet is hollow and pointed at both ends, the claim of its inventors being that this form reduced the atmospheric resistance encountered by the ordinary solid bullet. In the tests it was found that with a hollow bullet leaving the gun with a velocity of 3,000 ft. per second, at 2,700 yds., the remaining velocity was only equal to that of a solid bullet leaving the muzzle with a velocity of 2,000 ft. per second. The projectile energies of the two bullets were equal at 450 yds.; and, owing to the greater liability to deformation in the tubular bullet, the ratio of penetration into well-seasoned oak was as 7 to 16½ in favor of the service bullet.

New machine guns of 6 mm. caliber, are wanted by the U. S. Navy; and American and foreign inventors are invited to submit guns for test. The conditions require guns using smokeless powder and jacketed bullets, with a muzzle velocity of not less than 1,950 ft. per second.

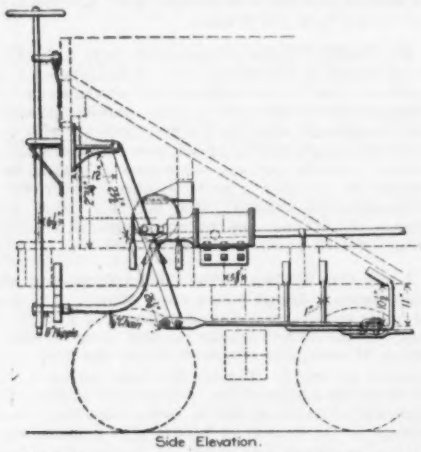
Another bullet-proof shield has been brought out, designed by Mr. W. J. F. Lennard, and is said to contain no metal. Satisfactory experiments are said to have been made with rifle bullets.

70,000-LB. HOPPER-BOTTOM ORE AND COAL CAR; PENNSYLVANIA LINES.

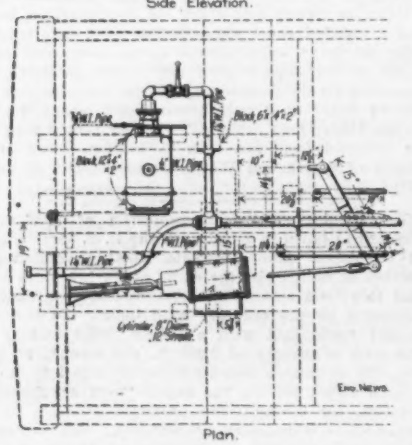
(With inset.)

The drawings on our inset sheet this week represent the latest type, or Class GG, of the self-clearing hopper-bottom ore and coal car of the Pennsylvania Lines West of Pittsburg. These cars are specially notable for their high-rated capacity and for several details in the construction, the design representing the latest modifications in the company's standard car for this class of service. The cars were designed by Mr. G. L. Potter, Superintendent of Motive Power of the Northwest System of the Pennsylvania Lines West of Pittsburg, with headquarters at Fort Wayne, Ind.; and we are indebted to him for blueprints and particulars.

There are various arrangements of hoppers for cars of this type, but almost invariably they are made with flat or horizontal doors swinging downward when opened, so that the bottom of the hopper must be kept at a sufficient height above the rail to allow of the full opening of the doors. In the 60,000-lb. coal car of the Chicago, Burlington & Quincy R. R. (Eng. News, March 9, 1893), the floor is flat at the ends of the car, and in the middle is a shallow hopper with all its sides sloping to an opening about 5 ft. wide and 2 ft. 8 ins. long, closed by two doors. In the Norfolk & Western R. R. coal car of the same capacity, the sides are vertical throughout, but the floor slopes from near the top of each end down to the hopper, the opening of which is the full width between side sills, obstructed only by the center sill, there being four clear openings of 2 ft. 10 ins. by 3 ft. 2 ins. The



Side Elevation.

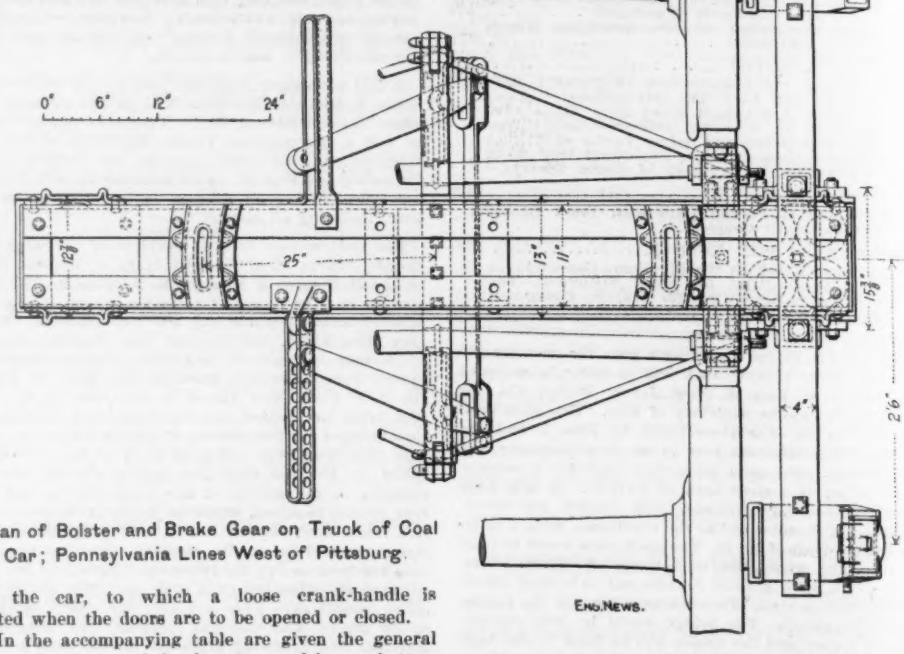


Plan.

Arrangement of Brake Equipment on the New Coal Cars of the Pennsylvania Lines West of Pittsburg.

53,760-lb. ore cars of the Duluth & Iron Range R. R. (Eng. News, Oct. 26, 1893) form one large hopper, with the floor above the sills, the ends sloping right up to the top of the body, and the lower part of the sides also inclined. This car has two openings (separated by a transverse timber) each 3 ft. 7 ins. by 3 ft. 6 ins., and closed by two flat doors.

In the new Pennsylvania R. R. car, shown on our inset sheet, the arrangement of the hopper doors is a notable feature, the doors being so hung as to be nearly vertical, and to be at the same height above the track when open as when closed, so that the hopper can be carried lower than when the ordinary drop doors are used. In this way a greater carrying capacity is obtained, together with a steeper slope for the floor of the hopper. In this car there is no flat floor. At the ends the floor slopes from near the top of the side to the bottom of the hopper, the hoppers being separated by steeply pitched slopes formed by the doors. Each hopper is also divided by a longitudinal ridge, and there are four inclined doors with openings about 27 ins. high and 36 ins. wide. The doors are operated by levers from a square shaft at the side



Plan of Bolster and Brake Gear on Truck of Coal Car; Pennsylvania Lines West of Pittsburg.

of the car, to which a loose crank-handle is fitted when the doors are to be opened or closed.

In the accompanying table are given the general dimensions, etc., of the four types of hopper-bottom cars above referred to, and also of the flat-bottom coal car of the Chicago, Rock Island & Pacific R.R.

As seen by the detail drawings, on our inset sheet, the Pennsylvania R. R. car has end sills 10 × 9 ins. at the middle, with the front face beveled off to make the end section 10 × 7 ins. There are two side sills and two center sills 10 × 5 ins., and two short intermediate sills 10 × 4 ins., which extend back to the transverse timber, which supports the floor of the hopper. Along each of these short sills is a 1-in. rod, with 1¼-in. ends, bolted through the end sill and the transverse timber. The frame is trussed by two 1½-in. rods, with 1¾-in. upset ends, placed against the inner side of the side sills, the rods being bolted through the end sills, and passing up over a saddle and then down at the side of the hopper, the ends being connected by an open-side turnbuckle. The draft rigging is placed between draft sills below the main sills, in accordance with the common practice.

The sides of the car are of planks, 11 × 3 ins., with riveted iron corner-plates, and an iron wearing strip on the top edge, this strip being secured by lag screws ½ × 2 ins., and by the ¾-in. vertical rods which pass down through the sides and sills. The sides are supported by heavy stakes, 5 × 3½ ins. at the base, fitted into stake pockets on the sills and secured to the sides by long ½-in. bolts riveted over. The main floor is of tongued and grooved planks 5½ × 2¼ ins., and the steep slopes and doors are of 5½× 1¾-in. tongued and grooved planks, as shown in the drawings. The floor, slopes and doors are covered with a 3-16-in. steel plate, secured by ⅜-in. drive screws with countersunk heads. At one end of the car is a brake handwheel, with a step or platform for the brakeman to stand on, and inside steps are placed on the side on which the locking arrangement is fitted.

The trucks are of the diamond-frame type with 33-in. wheels and a wheel-base of 5 ft. The brake-shoes are hung between the wheels. The top arch bar is 1⅛ × 4 ins., the lower arch bar 1 × 4 ins., and the bottom tie-bar ½ × 4 ins. The spring plank is a steel channel 13 × 4 ins., and ½ in. thick. The bolster is formed of two channels 7 ft. 4 ins. long, 3½ ins. wide, 13 ins. deep at the middle (where they are braced by vertical channel pieces), and reduced to 6 ins. at the ends, where a bearing-plate is attached for the top of the nest of four coiled springs. The width over the two channels is 11 ins.

The arrangement of the brake gear is somewhat novel, the cylinder and reservoir being under one of the inclined ends of the hopper, above the sills, while the train-pipe is carried along the center of

Details of Coal Cars.

	Hopper bottom cars.				Flat bottom car.
	Penn. Lines.	C.,B.&Q.R.R.	N.&W.R.R.	D.&I.R.R.R.	C.,R.I.&P.R.R.
Length over end sills	30 ft. 0 ins.	30 ft. 0 ins.	28 ft. 0 ins.	22 ft. 0 ins.	36 ft. 0 ins.
" " body	28 " 0 "	28 " 0 "	26 " 0 "	21 " 2 "	33 " 10 "
" " couplers	.. ..	.. ..	29 " 3 "	24 " 6 "	39 " 6¼ "
" of top of hopper	.. ..	12 ft. 10 ins.	26 " 0 "	17 " 6 "	.. ..
" " bottom of hopper	.. ..	3 " 3½ "	5 " 9 "	7 " 9¾ "	.. ..
Width over side sills	8 ft. 11 ins.	8 " 6 "	8 " 0 "	8 " 0 "	8 ft. 6 ins.
" " body	8 " 11 "	8 " 6 "	8 " 0 "	8 " 0 "	8 " 6 "
" of bottom of hopper	3 " 8 "	5 " 0 "	7 " 2 "	3 " 7¼ "	.. ..
Height, rail to bottom of side sill	3 " 3 "	2 " 6 "	3 " 2¾ "	3 " 9½ "	3 " 1½ "
" " " top of body	8 " 9 "	8 " 0 "	9 " 3¾ "	7 " 7½ "	6 " 8 "
" of sides	4 " 8 "	4 " 7 "	4 " 10¾ "	2 " 6 "	3 " 3 "
Depth of body at ends	0 " 10 "	4 " 7 "	1 " 9½ "	.. ..	3 " 3 "
" " " hopper	7 " 5 "	6 " 5 "	7 " 1½ "	3 ft. 9¾ ins.	.. ..
Size of bottom of "	36 × 31 "	38 × 60 "	86 × 67½ "	94 × 43½ "	.. ..
Wheelbase, truck	5 ft. 0 "	5 ft. 0 "	5 ft. 0 "	5 ft. 4 "	5 ft. 0 ins.
" total	24 " 10 "	25 " 0 "	22 " 0 "	19 " 0 "	30 " 10 "
Distance c. to c. of trucks	19 " 10 "	20 " 0 "	17 " 0 "	13 " 8 "	25 " 10 "
Wheels, diameter	2 " 9 "	2 " 9 "	2 " 9 "	2 " 9 "	.. ..
Weight of body, lbs.	.....	12,000	16,650	.....	15,080
" " two trucks, lbs.	.....	12,000	11,250	.....	11,520
" total, lbs.	35,000	24,000	27,900	24,400	26,600
Capacity, lbs.	70,000	60,000	60,000	53,760	50,000
Approximate cost	$550 to $575	$493	.....	$450	$475

the car, under the longitudinal ridge which traverses each hopper. The main lever to which the piston rod is connected is, therefore, in a vertical plane and its upper end is journaled on a bracket bolted to the inside of the end of the car. In the Chicago, Burlington & Quincy R. R. coal car, the reservoir and cylinder are placed end to end underneath one of the center sills, below the flat part of the floor; while in the Duluth & Iron Range R. R. ore car they are placed end to end against the inside of one of the side sills, under the side slope of the hopper.

The cars will have a marked or rated capacity of 70,000 lbs., which will permit of their being loaded to 77,000 lbs. and from the weight of the sample car which has been built it is estimated that the total weight of car empty, including trucks, will be about 35,000 lbs. When loaded to the maximum capacity this will give a total weight of 112,000 lbs., or 14,000 lbs. per wheel.

Contracts have been let and work is now in progress on 1,000 of these cars, 500 are being built by the Barney & Smith Car Co., of Dayton, O.; 100 by the Union Car Co., of Depew, N. Y.; and 400 at the Pennsylvania R. R. car shops at Altoona, Pa. The Janney coupler will be used on 700 of the cars, and the Tower coupler on 300 cars. The other equipment will include the Schoen pressed steel body and truck bolster, the Graham draft rigging and the Westinghouse air-brake.

MANUFACTURE AND PROPERTIES OF MALLEABLE CAST IRON.*

By H. R. Stanford, Assoc. M. Am. Soc. C. E.

Malleable cast iron is made principally from charcoal pig iron and a percentage of scrap or sprue sufficient to use the culled work, gates, runners and shrinkers resulting from the continued application of the process. The author made a number of experiments to determine the availability of coke pig iron as a substitute for the charcoal iron, and found it to be suitable when made with a good quality of coke, so as to keep down the sulphur content. The amount of sprue in the charge varies from 20% for coupler stock to 40 or 50% for that for light carriage work. An addition of 4% of heavy annealed scrap was introduced successfully into all charges, thus working off a large accumulation of cheap and undesirable iron.

Both cupola and open-hearth furnaces are used in the production of malleable cast iron, the former being employed for the lightest patterns and those in which a uniformly superior metal is not of special importance. The open-hearth furnaces used by the author are of two types—viz., a straight, forced-draft furnace burning a hard, close, bituminous coal, with an air pressure of 4 or 5 ounces, and a Siemens-Martin furnace using fuel oil.

After the castings are chipped and sorted, they are packed in pots holding about 800 lbs. of iron. Clean, heavy, forge scales seem to make the best packing, and the pieces have to be placed in the pots with considerable care in order to avoid distortion during annealing and to fill the pots as full as possible. A sprinkling of powdered quicklime, after the packing has been tumbled and raked, moistened a little with a solution of sal ammoniac, makes it less liable to pack hard in the burning and renders the dumping of the pots much easier. Oil was found superior to coal as a fuel in the annealing ovens, not so much from the standpoint of economy as because of its cleanliness and controllability. The time of the annealing varied more from the chemical composition of the iron than from the size or thickness of the piece, and ranged from three to ten days, including the time necessary to heat and cool the pots. The cost of annealing is 0.25 ct. per lb. in a 30-pot oven with two oil burners.

In order to be strong and malleable, the unannealed castings must have no graphitic carbon, but the total percentage must be in the combined state. With a given molten iron at a certain temperature, if the iron be poured into a mold of a certain section the casting will contain all of the carbon in a combined state, and the fracture of the annealed specimen will be of a uniform dark fibrous appearance. If the mold be of a smaller section, the casting made from the same iron will have the carbon in the combined state, but there will be a surface chill. If the mold be of a greater section, then the rate of cooling of the iron will be so slow that a part of the carbon will have time to separate from the iron as graphitic carbon, and will show in the fractured unannealed casting as scattered spots of graphite about as large as the head of a small pin. These three castings, if annealed, will show the following physical properties: The first will have an ultimate strength of from 42,000 to 46,000 lbs., will stretch and reduce about 6%, and may be considered a most desirable iron. The second will show in fracture a white crystalline skin, increasing in thickness as the section is lighter, with a black fibrous center; the ultimate strength will be about 52,000 lbs., and the stretch and elongation about 3.5%; if the section is so light that the whole fractured area is white, then the iron will be very malleable and tough. The third casting will be little better than gray iron, with a strength of from 25,000 to 35,000 lbs., depending upon the percentage of graphite in the unannealed iron, and with practically no stretch.

Sulphur is undesirable because of the hindrance it offers to annealing. To show this, couplers which analyzed about 0.04% sulphur, and in which there were sections about 1½ ins. thick, were thoroughly annealed in three and a half days, while iron bands for buggy wheels, which were no more than 3-16 in. thick and analyzed about 0.15% sulphur, were invariably hard if given less than five days. Phosphorus seems to be a very passive element and anything but the nuisance it is in steel.

* Abstract of a paper to be presented at the annual meeting of the American Society of Civil Engineers at Nantasket, Mass., June 18 to 22.

THE CHICAGO MAIN DRAINAGE CHANNEL.

III.

Summit Division.

The Summit Division of the Main Drainage Channel extends from the beginning of the channel, at Robey St., to the west end of Section G, a distance of about 7½ miles. Throughout the entire length of this division the channel is in earth and is 110 ft. wide on the bottom, with side slopes of 2 ft. horizontal to 1 ft. vertical. Mr. E. R. Shnable is the engineer in charge of this division,* and to him we are indebted for much aid in securing the matter from which the following articles on Sections O to G, inclusive, have been prepared.

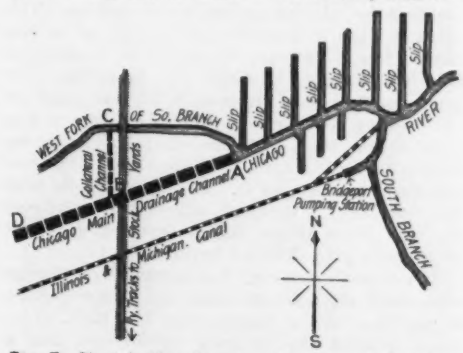


Fig. 5. Sketch Map Showing Location of Collateral Channel on Section O.

Sections O and N.—In accordance with the policy of the Board of Trustees to let the contracts for the more difficult portions of the work on the channel first, the contracts for Sections O and N, beginning at the eastern terminus, were not let until May 2, 1894. In bidding for the work on these sections, the contractors were given the alternatives of spoiling the material on the right of way or of conveying entirely from the right of way and disposing as they saw fit such portions as were not required in constructing levees and grading the neighboring land. The amount of excavation called for was 1,449,377 cu. yds. on Section O and 1,103,355 cu. yds. on Section N. For Section O there were 15 bids and for Section N ten bids, seven bids and four bids, respectively, giving prices for each of the alternative methods of disposing of the spoil.

The numerous streets and railways crossing this part of the channel, and the certainty that in the near future the channel would have to be enlarged, determined the Trustees to the opinion that the best interests of the district required the removal of the spoil from the right of way. For this proposition the lowest bidders were Green's Dredging Co., 19.9 cts. per cu. yd. for Section O, and Hayes Bros., 23 cts. per cu. yd. for Section N. Both Hayes Bros. and McMahon & Montgomery bid 23 cts. per cu. yd. for Section O, which price was next lowest after that of Green's Dredging Co. There was some question as to the formality of Green's Dredging Co.'s bid, and this, added to the desirability of having the two sections worked conjointly, or at least in close harmony with each other, led to a consolidation of forces by the three firms of contractors named, and on May 2 the contract for Section O was let to McMahon & Montgomery, and for Section N to Hayes Bros., with the understanding that Green's Dredging Co., the Fitzsimons & Connell Co., and the Chicago Dock & Dredging Co., should be associated in the work and sign the contracts with them. The price at which the work for Section O was let was 19.9 cts. per cu. yd. for material to be removed from the right of way, and 24 cts. per cu. yd. for the material to be used for grading and other purposes on the section. As it was calculated that 1,103,783 cu. yds. were to be removed and 425,000 cu. yds. retained on the section, these prices gave an equivalent price of 21 cts. per cu. yd. for the entire section. The price for the work on Section N. was 23 cts. per cu. yd.

Besides the main channel excavation, the work on Section O included the construction of a collateral channel 60 ft. wide on the bottom and 12 ft. deep, connecting the main channel with the West Fork of the South Branch of the Chicago River. This work was necessitated by the group of railway tracks which cross the main channel about the middle of Section O. Some trouble and delay were anticipated in securing the right of way underneath these tracks, and as it was not desirable to stop work during this delay, the Trustees decided to cut a collateral channel, and, after completing the main channel east of the track, to take the dredges along the West Fork to the point C (Fig. 5), and thence to the main channel at the point B west of the tracks, and continue west toward D. In addition to affording a temporary passage for the dredges, it was considered that the collateral channel would be useful to vessels desiring to pass from the West Fork to the main channel, when

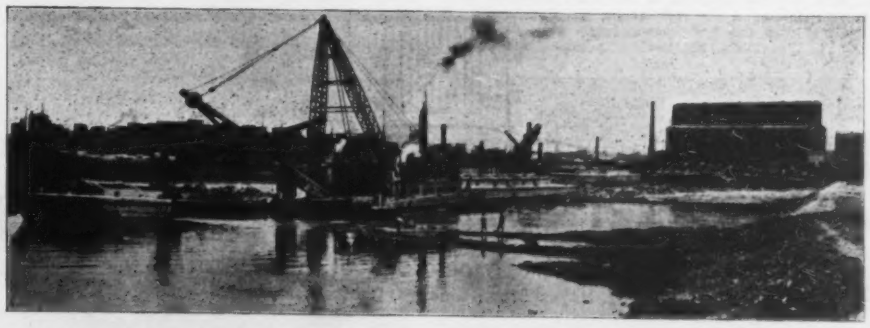


FIG. 6. DIPPER DREDGES AT WORK ON SECTION O, NEAR EASTERN TERMINUS OF CHANNEL.
McMahon & Montgomery, Chicago, Contractors.

*Previous to the reorganization of the engineer corps of the canal and the reduction of the number of "divisions" from five to four, Mr. Alex. E. Kastl, M. Am. Soc. C. E., had charge of Sections O to I, inclusive, under the name of the Brighton Division. In the reorganization M. Kastl was transferred to the main office of the Sanitary District, and his division merged into the Summit Division under the charge of Mr. E. R. Shnable. The old arrangement of the divisions was given in Eng. News May 9, and the new arrangement in Eng. News May 16. We wish to acknowledge much aid received from Mr. Kastl during his charge of the Brighton Division.

the latter was open for navigation. The price for excavating the collateral channel was the same as for the main channel work, 19.9 cts. per cu. yd.

At the beginning of the work, the contractors, McMahon & Montgomery and Hayes Bros., entered into an agreement whereby the latter firm was to remove the top soil down to hard material, and do the necessary grading and building of embankments on both sections, while the former firm was to excavate the hard material with dredges,

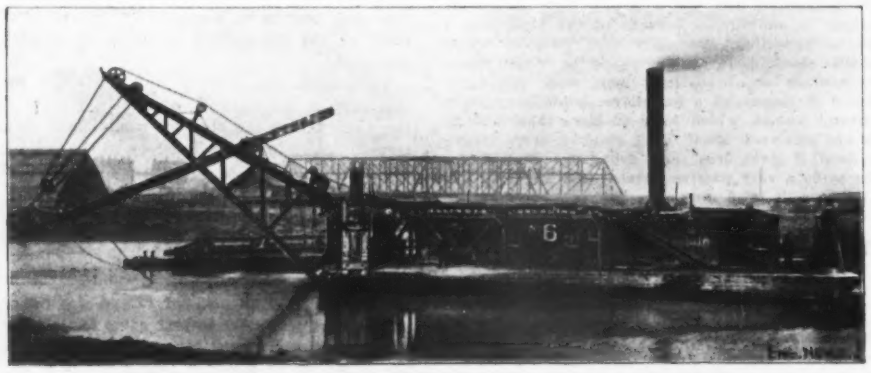


FIG. 7. STEAM DIPPER DREDGE AT WORK ON SECTION O.
Excelsior Iron Works, Chicago, Builders.

and convey it out into Lake Michigan and dump it. Work was begun on Section O in May, 1894, with wheel scrapers and dump carts for removing the top soil, and dipper dredges for handling the hard material. By the end of the month three dredges, four tugs and thirteen scows were at work, and this plant was increased to five dredges and 17 scows in June. A view of these dredges just as they had got well into work near the Chicago River is shown by Fig. 6. This view is looking east toward the city and Lake Michigan.

The average amount of material excavated by each dredge per ten hours, and the average scow load for five months were as follows:

	Excavation, cu. yds.	Scow loads, cu. yds.
July	860	...
August	780	230
September	520	186
October	560	181
November	400	...

Owing to the method of working, no figures of the output of individual dredges could be obtained, and the above figures assume each dredge to have done the same amount of work. Some of the dredges did better work, however, than others, and among these dredge No. 6, shown in the accompanying view (Fig. 7), was especially noticeable, both for the amount of material handled and for the small number of repairs required. This dredge was built by the Excelsior Iron Works, of Chicago, and is briefly described as follows:

The hull is 85 ft. long, 32 ft. wide and 8½ ft. deep, and is built of 8 × 12-in. oak timbers thoroughly braced together. Lengthwise of the hull run two steel trusses, which carry at their forward ends a cross girder supporting the upper mast box. These longitudinal girders are 17 ft. high and are built of ⅜-in. plates and 4 × 4 × ½-in. angles. A strong system of lateral bracing holds them firm laterally. Braced to the longitudinal girders are the casings for the forward spuds, which are 2 × 2-ft. oak timbers 30 ft. long shod with a cast iron shoe. These spuds can be raised by hand, but ordinarily they are operated by 20-in. diameter steam cylinders. The rear spud is operated in a similar manner, but is somewhat smaller than the side spuds.

The upper end of the crane is 38 ft. above the bottom mast box, and it is built of 1½-in. steel plates and 4 × 6 × ½-in. angles. The crane sheaves are 48 ins. and 38 ins. in diameter, and are mounted on a 3½-in. shaft, and the crane trusses are fastened to the mast by top and bottom castings. This mast is 9 ins. in diameter, and is made of the best forged iron. The turntable is 17 ft. in diameter and is constructed of steel. The dipper has a capacity of 2 cu. yds. It is made of ⅜-in. steel, reinforced by wrought iron bands, and has a 1-in. steel cutting edge. All forgings belonging to the dipper, as bail, hinges, pins, etc., are of the best quality of iron obtainable. The dipper handle is 35 ft. long, and is made of oak timber, reinforced by steel cover plates, and is provided with cast steel racks with shrouded teeth.

The power machinery for operating the dredge consists of the usual swinging and dredge engines. A duplex reversing engine, with 7 × 12-in. cylinders, operates the swinging mechanism, and a duplex hoisting engine, with 14 × 16-in. cylinders, operates the dipper. The dredge engine is geared by spur gearing to the drums, both of which are provided with conical friction clutches operated by steel thrust screws. The hoisting drum is 30 ins. in diameter and the backing drum 14 ins. in diameter, and both have 42-in. faces. The boiler is of the locomotive type, 72 ins. in diameter and 13 ft. long, and has a 4½ × 5-ft. firebox. The total heating surface is 900 sq. ft.

A dredge precisely like this dredge in design and construction, but differing somewhat in size, was illustrated and described in detail in our issues of Sept. 14 and 21, 1893.

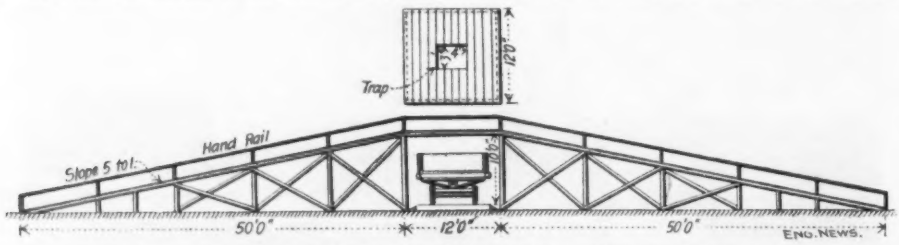


FIG. 8 INCLINE FOR LOADING GONDOLA CARS, SECTION N.
Hayes Bros., Chicago, Contractors.

The methods adopted for removing the top soil were all simple, and call for but little mention. Wheel scrapers were extensively used on both sections. When the material was to be used in levee construction or grading on the right of way, no other conveyance than the scrapers was required, but for the material which had to be taken away dump cars, wagons, etc., had to be used. On Section N gondola cars were used to a considerable extent to carry the dirt from the right of way. Fig. 8 shows the manner of loading these cars with wheel scrapers. The railway track was laid parallel to the edge of the excavation, and these inclines were built at convenient points along the track. With this apparatus the average capacity of each wheel scraper, with a full working force and under favorable conditions was 60 cu. yds. car measure per 10 hours. The cost of each incline was about $100. For the matter from which our illustrations and this article have been prepared we are indebted to the contractors, McMahon & Montgomery and Hayes Bros., the Excelsior Iron Works, Division Engineer Mr. E. R. Shnable and other engineers of the Sanitary District of Chicago.

AN EXPERIMENTAL STUDY OF FIELD METHODS WHICH WILL INSURE STADIA MEASUREMENTS OF GREATLY INCREASED ACCURACY.*

By Leonard Sewal Smith, Mem. W'n Soc. of Engrs.

The invitation to present the results of my investigations of this subject to your society was accepted because St. Louis is recognized as the center of greatest interest in stadia work—the inevitable result of its extensive use on your city and river surveys. If the deductions of this paper are somewhat new, it is hoped that the methods of investigation by extensive and painstaking experiments will claim your attention and confidence. The collection of data was begun during the field work of the International Boundary Survey between the United States and Mexico, 1892-3, merely as a study of a certain phenomenon familiar to engineers by the name of "boiling of the air." In the summer and fall of '94 this systematic study was continued in Wisconsin, but was made to include also an experimental study of the effect of this "boiling" upon the accuracy of stadia measurements.

It was found that, during all but the cold months, this unsteadiness and other related disturbances do not differ greatly, either in character or degree, even in such extreme latitudes as New Mexico and Wisconsin. When this study was begun it was thought that this unsteadiness exercised a governing influence on the accuracy of stadia work, but while the evidence proves that this is not the fact, it has been the means of discovering what the governing factor is.

Theoretically, the only errors to which the stadia method is subject are compensative errors; but practically, the actual results of all such measurements have been uniformly disappointing, because they have been bristling with large systematic errors, often so large as to entirely cover up the accidental errors. A few prominent instances of systematic errors may be named, but all stadia engineers have seen, in their own experiences, many examples of such accumulating errors.

Thirty-nine miles of the writer's own stadia measurements on the New Mexico boundary line,** parallel of 30° 21°, were checked at intervals of 2.5 miles by a triangulation. Every one of the 14 checks showed the error of the stadia to be positive (too long), the average error being 1 in 670; while the measurement of this same line by the Mexican engineers showed a somewhat larger error in the opposite direction. The engineer in charge of the stadia surveys of the Chicago Drainage Canal, surveys already covering 50 sq. miles, states that the steel tape and triangulation checks on this work show that all stadia measurements were too short, the average error being about 1 in 700. Again, the report of the recent survey of St. Louis*** shows undoubted proof of systematic positive errors, which lead the engineer in charge to advocate a method of interval determination which virtually subtracts 43 cm. from every stadia reading. The experimental work discussed by this paper will show that practically, as well as theoretically, these systematic errors are not inherent in the stadia method, and only a single and easily applied change in present field

* A paper read before the Engineers' Club of St. Louis, April 17, 1895, a resume of a thesis offered to the faculty of the University of Wisconsin for the advanced degree of Civil Engineer, and to be published in the Engineering series of the University Bulletin.

** The whole boundary line from El Paso, Tex., to the Pacific Ocean was measured by the stadia, after a comparative test of both chain and stadia on the first 100 miles.

*** Journal of the Association of Engineering Societies, Vol. XII., p. 1.

methods is required to greatly modify, if not entirely prevent, such errors.

But because this subject is quite intimately related to the unsteadiness or so-called "boiling of the air," let us first briefly glance at the various conditions governing the same. This unsteadiness seems to be due to the irregular displacement of light rays, both in a horizontal and vertical direction. The horizontal displacement appears to affect the accuracy of the stadia only by decreasing the distinctness of the image (see Fig. 3), while in addition to this, the vertical vibration furnishes other causes for error, as is explained below. A brief statement of how the amount of the vibration was measured may be of interest. The target, shown in Fig. 2, being attached to the back of a metric rod, shown in Fig. 1, the rodman held same at 100 or 150 paces, showing first face, then back of rod. After reading the stadia for distance the middle cross-wire was placed so as to bisect that strip on the target which equalled the amplitude of the vertical vibration. The number of vibrations per minute was then counted, each experiment being repeated a number of times, and the average result recorded. In general each vertical vibration

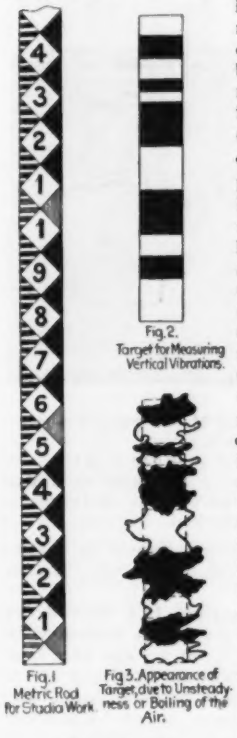


Fig. 1 Metric Rod for Stadia Work. Fig. 2. Target for Measuring Vertical Vibrations. Fig. 3. Appearance of Target, due to Unsteadiness or Boiling of the Air.

Figs. 1 to 3.

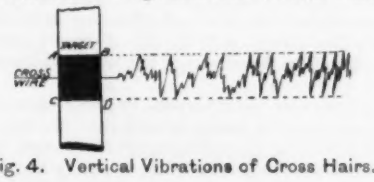


Fig. 4. Vertical Vibrations of Cross Hairs.

was found to be made up of two classes of movements—a fast one, with short amplitudes, and a slow or irregular vibration, with long amplitudes. This latter will be called the primary, and the former, secondary vibrations. The manner in which these two systems would occur can be best shown by a diagram. If the cross-wire could record its apparent motion, it would describe a path like that in Fig. 4, where B-D limits the amplitude of the primary vibrations, and the irregularities of its path constitute the secondary system.

The manner in which the amount of this vibration is influenced by length of sight, hour of day, brightness of sun, temperature, etc., can be best shown by the typical curves representing the same. In Fig. 5 the x co-ordinates of the curve are the recorded amplitudes of the swing of cross-wire. It will be seen that the greatest disturbance comes not in the hour of maximum temperature, but in the hour of maximum DIFFERENCE of temperature between air and earth. In Figs. 5, 6 and 7 this hour is 10—11 a. m. The curves of Fig. 8 may be said to be typical of sunny days during all except the cold winter months. During a cloudy day, even with high temperatures, but little unsteadiness is observed. The effect of different amounts of cloud is clearly shown by the curves of Fig. 9, which record a measurement of the vibration at the same hour of three different days under same circumstances, except the degree of cloudiness.

It is thought that the product of the number of vibrations (per minute) and their amplitude is a better measure of the amount of the unsteadiness than either factor alone. Using this product for the values of y, and the hours of the day for the values of x, the curves in Fig. 10 are obtained.

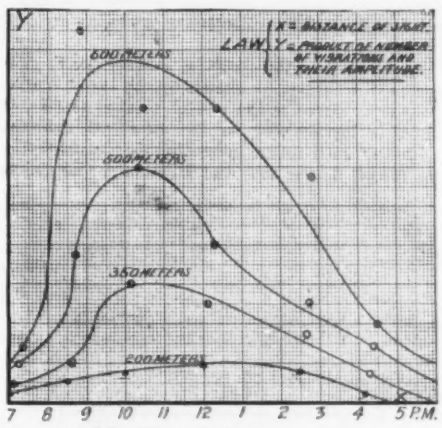


Fig 10. Typical Disturbance Curves.
Showing Effect of Hour and Distance. Tull Mountains, Arizona, May 20.

The irregular movements constituting this unsteadiness cause errors in rod readings because of the impossibility of reading both stadia wires simultaneously; but as such errors are as likely to be positive as negative, they would follow the law of compensating errors, so only the square root of the number of errors would, in any case, accumulate. Evidently the cause of systematic errors is not here. But while engaged in this study of the air, it was noticed that rod readings made when such disturbances were very marked, differed SYSTEMATICALLY from those made under steady conditions of the air; a careful study was accordingly made to discover the cause. It was soon apparent that this cause was what the writer, for want of a better name, has called "differential refraction." As used in this paper, the term "differential refraction" expresses the difference in the amounts which the two lines of sight, upper and lower, are refracted by the air.

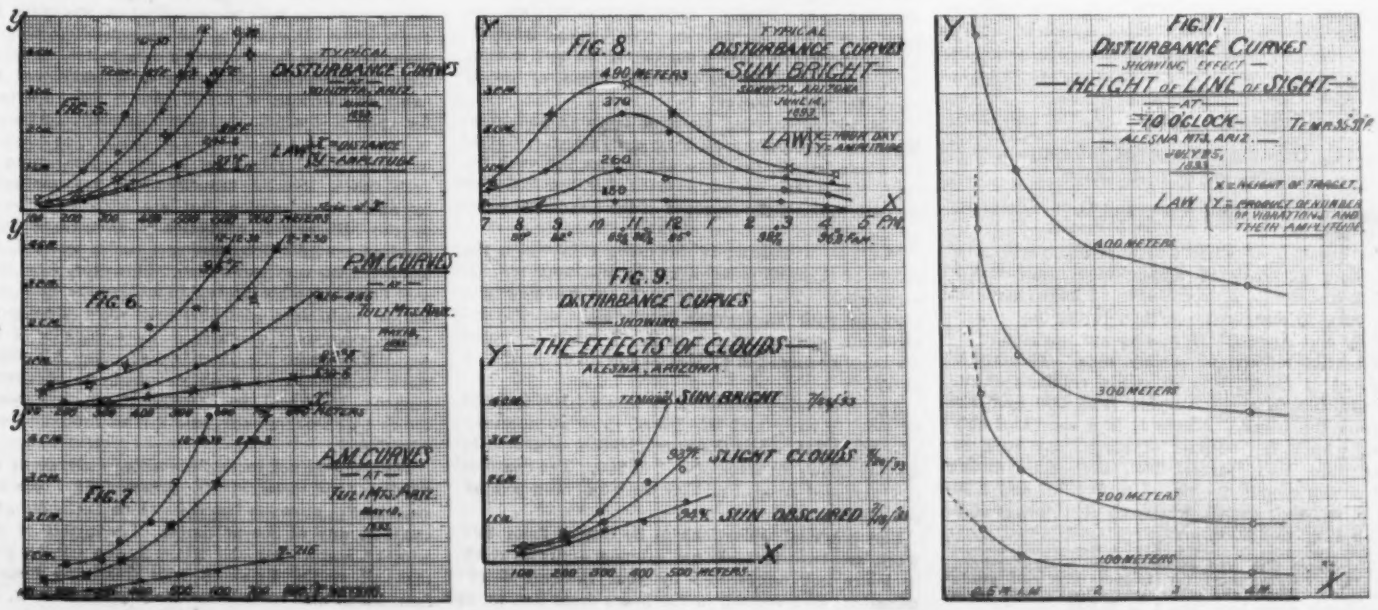
One explanation for this unequal refraction is this: in the morning, before the earth has received heat from the sun, the density of air is greatest at the surface, and decreases upward, though in the limits affecting stadia work this change in density must be slight. But later on in a sunny day the temperature of the stratum of air next to the earth becomes heated by the radiation of the earth's heat. This increased temperature causes a rarefaction which, within a short distance of the ground, makes the density of the air increase upward. Rays of light traversing this stratum are bent upward, obeying the law that the concavity of the path of a ray of light must be turned toward the denser part of the medium.

Experiments to determine the depth of this abnormal stratum indicate that, while it varies at different hours and seasons, that portion of it in which the change of density is most rapid is never more than 4 ft. deep.

If the lower line of sight traverses this low stratum, it suffers a greater refraction than the upper line of sight, the difference in the amounts representing the actual error of the rod reading.* As the amount of this differential refraction has been found to vary directly with the unsteadiness of the image, some experiments were made to determine the relative amounts of unsteadiness in strata from ½ m. to 4 m. above the ground, the results of which are given a graphical form in the curve, Fig. 11. The abscissas of the curve are the heights of the target above the ground, and the ordinates are the products of the number of vibrations (per minute) and their amplitude. It is seen that between ½ m. and 1 m. a rapid change in the amounts of unsteadiness was found, while between 1 m. and 4 m. the change was slight. Referring to Fig. 11, it will be seen that on the 200-meter sights the unsteadiness at 4 m., 1 m. and ½ m. above the ground was in the ratio of 5:6:9, that is the rate of change of unsteadiness between ½ m. and 1 m. was 18 times that between 1 m. and 4 m.

The remarkable refraction which takes place in this stratum of greatest unsteadiness is best explained by the peculiar funnel shape of the ascending currents of air, caused by the radiation of heat from the various materials of the surface along the line of sight, a typical case of which is shown in Fig. 12. Each belt of sand, clay, loam,

* It should be noted that the conclusions of this paper depend upon observed facts, but in nowise on this or any other explanation.



FIGS. 5 TO 11. DISTURBANCE CURVES FROM OBSERVATIONS TAKEN UNDER VARIOUS CONDITIONS.

gravel or covering of vegetation will absorb and give off heat to the superimposed air, according to its own absorbing and radiating power, giving rise to ascending air currents of different densities

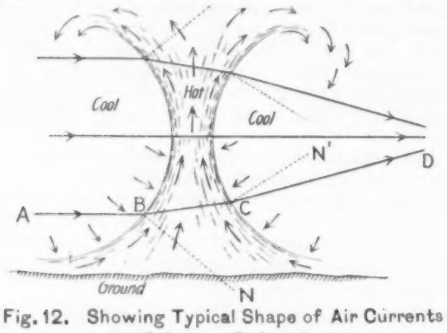


Fig. 12. Showing Typical Shape of Air Currents and Effect on Refraction.

and corresponding indices of refraction. Rays of light which traverse the lower part of such a lens will be refracted the most. This agrees with the observed facts, as seen both in experiments of natural and artificial conditions. Again, the almost infinite variety of ways in which rays of light may traverse the large number of such currents, when influenced by every gust of wind, is sufficient to explain the peculiar fluctuations which have been termed "secondary" and "primary" vibrations.

Additional evidence of the increased refraction in the stratum next to the ground is found in the following experiments made in Wisconsin the past summer.

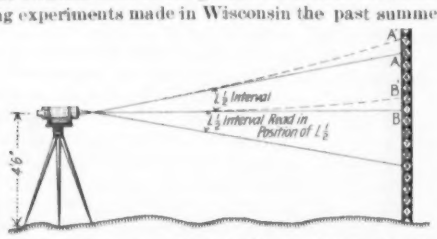


Fig. 13. Showing Small Differential Refraction with High Height of Instrument I, and Reading on Upper Portion of the Rod.

With usual height of instrument, readings aggregating 2,774 m. were read on different distances by half intervals on the upper and clearer portions of the rod. Then the transit was lowered to the ground and the same distances read on the lower part of the rod. The latter readings show the large systematic error of — 1 in 166, while the former were not sytematic, and the resulting error was but + 1 in 1,155. This is an extreme case, because the time was in midday. What doubtless took place here is shown in Figs. 13 and 14. In the first case (Fig. 13) both lines of sight traversed strata of nearly equal refracting power, so the rod intercept was subject to only small error; while with low height of instrument (Fig. 14) these conditions being reversed,

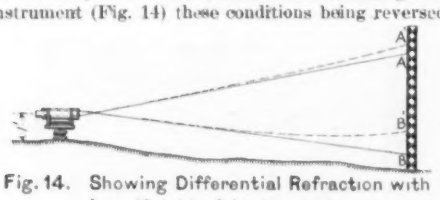


Fig. 14. Showing Differential Refraction with Low Height of Instrument.

unequal refraction took place, and large systematic errors resulted.

The question of what length of sight will give maximum accuracy of measurement was tested by 422 test sights, aggregating* 85 miles, made on an accurately measured base line, during the mouths of July and August. Here also are the results of "differential refraction" plainly seen. This work consisted of from 20 to 30 stadia readings on 19 stations, 100 ft. apart, varying from 200 to 2,000 ft. from the transit. Table I. is a record of this work, which, for purpose of study, has been divided into two parts: first, that done during good seeing conditions—viz., 7 to 9 a. m. and 2:30 to 7 p. m., and, second, work executed during midday—9 a. m. to 2:30 p. m.

* This base line was measured by a standardized steel tape. Corrections for temperature and grade were made. These and other precautions taken made the probable error less than 1 in 25,000.

Of the 217 readings taken during the good-seeing conditions 66% of the errors were positive, 30% negative and 4% zero; while for midday work the proportions of negative and positive errors were about reversed. But these proportions do not correctly express the relative amounts of positive and negative errors, for the reason that in the first division of work the positive errors were larger than the negative, and in the second case the negative errors were many times as large as the positive. The cause of the larger systematic errors of midday work compared with the errors of other hours will be found in the method of interval determination. This interval was made at hours which did not represent the conditions obtained at midday—10 a. m. to 3 p. m.—Especially on account of the effect of refraction; such an interval would not be accurate for work done under conditions obtaining at midday, thereby causing systematic errors. Thus, the probable or average error of a single reading made during morning and evening hours was about 1 in 1,000, while, during midday, the error was 1 in 430 for sights less than 1,000 ft. in length, and 1 in 200 for sights 1,100 to 2,000 ft. in length.

The manner in which the probable error of a single sight is affected by length of that sight, is shown by the curves in Figs. 15 and 16. In both curves the abscissas are the length of sight in feet, while the ordinates are the probable errors of such length of sight. The heavy curve is simply an average one.

Fig. 15 records the result of midday work. The decreased accuracy, as shown by the rapid descent of the error curve to the axis of x, after the 500-ft. sights, is largely due to the effect of excessive fraction at such times, increasing as the lower line was forced deeper into the stratum of maximum

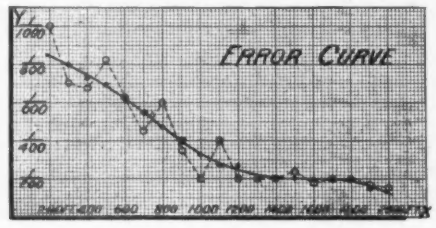


Fig. 15. Error Curve for Midday Work (9 a. m. to 2 30 p. m.)

204 Test Sights, Aggregating 41.3 Miles, on a Base Line Using Sights of 200-2,000 ft. in Length, East Troy, Wis., August, 1894.—Law, same as Fig. 13.

Summation of Results.

Time.	Short sights.	Long sights.	Totals.
Morning and evening work.	Av. err. sin. sight on 12.6 miles = + 1-1,088	Av. err. s.n. sight on 30.9 miles = + 1-935	43.5 mi. + 1-1,700
Midday work.	Av. err. sin. sight on 11.4 miles = — 1-655	Av. err sin. sight on 30 miles = — 1-209	41.4 mi. — 1-257

refraction. The regularity of this curve is evidence of systematic errors. This rapid descent was arrested at the 1,100-ft. sight, because this and the remainder of the sights were read by half intervals on the upper and clearer portion of the rod, causing both lines of sight to traverse strata of nearly equal refracting power.

Fig. 16 representing work of morning and evening hours, presents a striking contrast, for, during its whole length, the error curve does not vary far from 1 in 1,000, while the marked irregularities of its path indicate the presence of the accidental errors of observation.

Not less interesting is the manner in which the errors of these 85 miles of stadia measurements accumulated. The 12 miles made in morning and evening, with an average length sight of 600 ft., show an accuracy of + 1 in 2,685, while the same distance measured in midday shows an error of — 1 in 655.

Again, 30 miles measured by sights 1,100 to 2,000 ft. long, in early and late hours, show an accuracy of + 1 in 1,741, while the same distance measured in midday shows an error of — 1 in 209. The cause of the increased error of midday work has been pointed out above.

The practical deductions to be drawn from this work are two: first, do not attempt accurate work in hours not represented by your interval determination; and, second, in the hours from 9 a. m. to 2:30 p. m. do not take sights which require the lower line of sight to pass nearer than 4 ft. from

Thus, Table I. shows that of the 28 m. of ac-

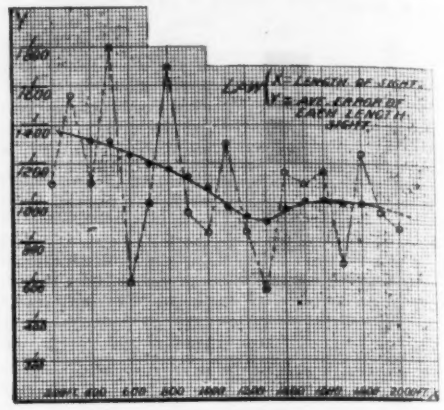


Fig 16. Error Curve for Morning and Evening Work.

(Before 9 a. m. and after 2.30 p. m.)

217 Test Sights, Aggregating 43.5 Miles on a Base Line, Using Sights of 200-2,000 ft. in Length, at East Troy, Wis., August, 1894.

the ground. If long readings cannot be avoided, take them by half intervals on the upper portions of the rod.

cumulated error in measuring 11.4 miles during midday hours, 23 m. were due to measurements using sights of 900 and 1,000 ft., and only 5 m. to the 200, 300, 400, 500, 600, 700 and 800-ft. sights. Had the 900 and 1,000-ft. sights been omitted, the resulting error of all short-length sights during all hours would have been but 1 in 11,400 on the 20 miles of such work.

That such a close balancing of positive and negative errors is always possible is not to be expected; but that a careful planning, with the view of preventing systematic errors, will always give superior results, seems too apparent to need further emphasis. Unfortunately for the interests of the stadia method, the effect of refraction in producing cumulative errors and the use of proper methods for preventing the same are not well understood by stadia engineers.

For instance, one prominent engineer of wide experience with the stadia argues that the best time for determining the stadia interval, as well as the best time for any stadia work, is during the middle of the day. He bases his reasoning on two facts: first, that during the middle hours of the day atmospheric refraction is at a minimum; and, second, that during such hours the change in refraction is slight. All this is true, but it has no bearing on stadia work. His error results from the fact that he is treating his patient for the wrong disease—that is, for absolute refraction instead of "differential refraction." The writer has reason for believing that the misunderstanding on this point is a general one. It would be just as sensible to give the usual remedies for pneumonia to a patient suffering from consumption. Nor can it be said that the name or diagnosis of the disease is not important, for upon it depends the proper remedy. Absolute refraction is at a minimum near midday, as claimed; but differential refraction is near a maximum at such times. Stadia measurements are unaffected by absolute refraction, but are seriously affected by the "differential refraction." Instead of being the best time for determining a stadia interval, the midday is the very worst time. However, if an engineer determines his interval in midday, the work done during such time will obviously show greater accuracy than work executed in the remainder of the day. But unless he intends to confine his stadia work exclusively to midday (which is, of course, absurd), he would be inviting large systematic errors by choosing such time for his interval determination.

That this is not mere theorizing, a glance at the results of the recent stadia survey of St. Louis will abundantly prove—a survey which is fully the equal of any of recent times. The report of this survey* states that the triangulation checks show that all stadia distances were read too long, a fact which the records certainly prove. Now, let

TABLE I.—RESULTS OF 422 TEST SIGHTS ON A MEASURED BASE LINE.

Work done from 7 to 9 a. m. and from 2:30 to 7 p. m.								Work done from 9 a. m. to 2:30 p. m.							
Short sights.				Long sights.				Short sights.				Long sights.			
Length of sight, m.	Sum of distances, m.	Accumulated error, m.	Ave. error of single sight.	Length of sight, m.	Sum of distances, m.	Accumulated error, m.	Ave. error of single sight.	Length of sight, m.	Sum of distances, m.	Accumulated error, m.	Ave. error of single sight.	Length of sight, m.	Sum of distances, m.	Accumulated error, m.	Ave. error of single sight.
60.97	853.58	+ 0.51	1-1,108	335.33	3,688.57	+ 1.55	1-1,322	60.97	792.61	+ 0.07	1-1,020	335.33	3,688.57	— 8.89	1-336
91.45	1,097.40	— 0.07	1-1,545	365.81	4,755.53	+ 3.35	1-896	91.45	914.50	— 1.22	1-682	365.81	4,755.53	— 20.96	1-209
121.94	1,219.30	+ 1.10	1-1,108	396.29	3,962.94	+ 4.12	1-563	121.94	1,585.19	+ 0.54	1-677	396.29	3,566.64	— 16.93	1-194
152.42	1,829.04	— 0.04	1-1,703	426.78	5,121.35	+ 3.50	1-1,153	152.42	1,371.81	— 1.53	1-821	426.78	5,548.13	— 26.00	1-202
182.91	2,560.70	+ 3.75	1-623	457.26	4,115.37	+ 0.40	1-1,106	182.91	2,194.88	+ 2.79	1-625	457.26	5,020.89	— 18.65	1-236
213.39	2,560.68	+ 1.45	1-1,004	487.75	5,852.98	+ 0.16	1-1,134	213.39	2,132.90	— 3.06	1-462	487.75	5,852.98	— 30.43	1-184
243.87	3,414.24	+ 0.20	1-3,556	518.23	5,182.32	+ 7.49	1-674	243.87	2,926.49	— 2.29	1-1,104	518.23	4,664.09	— 21.58	1-212
274.36	3,017.94	— 0.02	1-961	548.72	6,035.89	+ 3.30	1-1,262	274.36	2,469.22	— 7.39	1-338	548.72	6,035.89	— 29.49	1-204
304.84	3,658.10	+ 0.64	1-870	579.20	5,212.80	+ 2.68	1-951	304.84	3,962.95	— 16.91	1-216	579.20	4,054.40	— 23.74	1-171
.....	.....	.....	.....	609.68	5,487.15	+ 1.85	1-878	.....	.....	.....	.....	609.68	4,877.47	— 33.03	1-148
Ave. length of sight.	Total distance.	+ 7.52	Ave. err. single sight.	Ave. length of sight.	Total distance.	+ 28.40		Ave. length of sight.	Total distance.	— 28.		Ave. length of sight.	Total distance.	— 220.78	
182.0 m. (600 ft.)	20,210.98 m. (12.6 miles)	+ 1-2,685	1-1,088	466 m. (1,528.+ ft.)	49,414.90 m. (30.1 miles)	+ 1-1,741	1-935	182.+ m. (600 ft.)	18,351.55 m. (11.4 miles)	— 1-655	1-432	462.+ m. (1,515.+ ft.)	48,073.00 m. (30 miles)	— 1-209	1-201
111 sights.				106 sights.		Total—217 sights.		101 sights.				104 sights.		Total—205 sights.	
6 zero errors, 6%				2 zero errors, 2%		143 plus errors, 66%		61 minus errors, 60%				96 minus errors, 92%		157 minus errors, 77%	
69 plus " 62%				74 plus " 70%		66 minus " 30%		40 plus " 40%				8 plus " 8%		48 plus " 23%	
36 minus " 32%				30 minus " 28%		8 zero " 4%									

Summation—422 sights.

191 plus, 45%; but 13% of total amount of error.
223 minus, 53%; " 87% " " " " " "
8 zero, 2%

us inquire into the methods of the interval determination. The engineer in charge gives out the following facts: The interval of the single transit used on stadia work was determined by a single observer, and made to depend upon 10 observations, taken at some certain half hour of a July day, over ground and in weather that are admitted differed widely from the average conditions met during the three years of field work. If, in the absence of knowledge of what the hour of interval determination was, we assume that the engineer followed his own advice and chose the middle of the day, the explanation for excessive readings is plain to be seen.

During summer days the rod readings become a minimum at about 11 o'clock, so that, in the common stadia equation $D = K\,S,\ K, = \left(\frac{D}{S}\right)$ will be too large, since S is too small for work, except in midday. As a result of using too large a value of K, you would expect distances to be too great. Such was the fact. Had the midday hours been omitted from the interval determination, work done during midday would have been subject to large systematic minus errors, as was actually found in the writer's work. This is also the explanation for the systematic minus errors found in the stadia work of the Chicago Drainage Canal, to which reference has been previously made.

That the accuracy of long line measurements need not be limited to 1 in 700 is shown by the stadia measurements* of the 45 miles of the Mexican boundary line east of the Colorado River, across part of the Yuma Desert. The triangulation check shows that the accumulated error on this distance was — 39 meters, or 1 in 1,874. The interval used in this work was determined in morning and evening hours, but considerable work was done in the intervening hours, thus again explaining the presence of minus errors.

When a survey continues through widely different conditions, such as summer and winter, it certainly would be wise to redetermine the interval. In every such determination let every condition affecting it be as nearly as possible equal to the average condition to be met in the field. For example, if the survey is to be over ordinary soil, do not determine the interval on a stone curbing; if the rodman is not to be aided by a plumb-line in holding the rod in the field, do not suffer such aid in the determination; and, above all, let each man who is to use the transit determine an interval for his own use, for in this way you will eliminate the systematic errors due to his personal equation.

In order to discover to what extent errors would accumulate while making a long stadia measurement under actual field conditions, 13 independent stadia measurements of the base line were made by the writer. The method adopted in making these measurements insured the determination of each distance being independent of any knowledge of what such readings should be. The transit was nearly always set up at an undetermined point on the line, and seldom twice on the same place. As only one rod was available, only a single stadia line was run, but there is reason for the belief that the accuracy obtained could have been improved by both (fore-sight and back-sight) on each distance.

The average error of the 13 measurements of the base line (2,217 m.) was 2⅓ ft., or 1 in 2,250. It was found that the longer the measurements, the greater became their relative accuracy, because of the compensation of errors. Thus beginning with an error of 1 in 2,100 on the first measurement of the base, at the end of the fourth (8,868 m.), seventh (15,518 m.), tenth (22,169 m.), and thirteenth measurements (28,820 m., 18 miles), the uncompensated errors were respectively 1-2,900, 1-6,200, 1-14,400 and 1-10,400.

The average error of the eight morning determinations of the base line was — 1 in 1,900, while that of the five afternoon determinations, using 20% longer sights, the average error was + 1 in 3,185, thus indicating the greater reliability of afternoon work. The largest errors in measuring the base line were those gotten by using the long sights of 369 m.; the shorter sights gave uniformly very much smaller errors. The total time spent in measuring these 18 miles was 14 hours, or at the rate of 13 miles per day of 10 hours. A double stadia line—i. e., one with both fore-sight and back-sight—could, with two rodmen, be measured in about the same time.

This base line was laid out on four streets forming a quadrilateral. The sun was unobstructed from "A," "B" and "C" Sts., while the presence of shade trees on "D" St. exposed it to alternate belts of sun and shade. The result of the 13 measurements of this street is in striking contrast to those of the other three. Thus, while the average error of a single measurement on "A," "B" and "C" Sts. was 1-3,346, 1-1,977 and 1-2,065, respectively, that of "D" St. was 1-1,023. As every condition affecting the measurements of all four streets was exactly the same, excepting this one matter of alternate belts of sun and shade on "D" St., the greatly increased error on this latter street seems justly attributable to this peculiar condition. It must be admitted, therefore, that the presence of the unusually large number of such abnormal conditions in every city will doubtless increase both the accidental and systematic errors of stadia measurements made therein. It should be noted that, though the average error of a single measurement on "D" St. (797 m.) was 1 in 1,023, the total accumulated error of 10,355 m. (6.4 miles) of stadia measurements made on this street was only 1 in 4,470; plainly showing that such measurements, while affected with relatively large accidental errors, were not affected by systematic errors. The accuracy of past stadia work has been limited, not by the accidental, but by the systematic errors of such work.

A somewhat wide correspondence with experienced stadia engineers indicates that at present hardly any two agree as to the proper time for determining the stadia interval, there being as many opinions as there are hours of the day. Each one thinks his own hour represents average conditions and one of them may be right. If the conclusions of this paper are correct, all are individually wrong, and yet collectively right. Determine the interval, not at any one hour, but during all field hours, so as to approximate as closely as time allows the average conditions of field work. The degree of accuracy which will result should correspond closely to the degree of such approximation.

The chief objection to this added care, both in the original determination and also in any subsequent one, made necessary by a decided change in field conditions, will doubtless be the cost of repainting the rods in the latter case, and the cost of such added care in both cases. The first objection would be entirely removed by not incorporating the interval in the rod design, as is at present so generally done, but instead using rods divided into standard units of length; this involves the computation of true distances by means of an interval factor, but with a table such computations can be very quickly made. All the measurements discussed by this paper were thus computed. This point is ably discussed by Mr. J. L. Van Ornum, of Washington University, in a forthcoming paper before the American Society of Civil Engineers. He names the following as some of the advantages of the interval factor method over the old method: (1) Subsequent tests of interval can be made without the expense of repainting and regraduating the rod. (2) Rods can be interchanged among transits. (3) Rods can be used by observers having different personal equations. (4) Old rods can be used with new transits. (5) Rods can be used in leveling, without computing any correction. (6) Leveling rods can be used as stadia rods. These advantages are so evident, that the adoption of the interval factor method seems largely a question of the time necessary to teach "old dogs new tricks."

The second objection to exercising greater care on the interval determination is more fancied than real. Increased accuracy of any work usually involves increased care or money, or perhaps both. The real question is, Will the results of such care justify increased cost? It has been shown that this care prevents, in great measure, the large systematic errors which, up to the present time, have confined the use of the stadia methods within narrow limits. But on one of the surveys with which the writer is acquainted, the cost of the steel tapes worn out in making measurements where the stadia method might have been employed, has exceeded the cost of either the repainting of the rods or the cost of the increased care in interval determination. Again, it should be noted that in surveys extending over a year or more, and furnishing frequent triangulation or steel tape checks on the stadia measurements, each check may be used as an interval determination, and the average of a number of such determinations would give the very best value for the interval to be used in future work, without the expense of an extra dollar or an extra hour of time.

Some will say the present method is good enough; and so it is for a large class of work, but for a much larger class of work it is not sufficiently accurate. The stadia method is such a convenient and economical one to use, that it would seem a step in the direction of progress to give the method increased accuracy, especially as this can be done at so little expense.

* See Journal of Associated Engineering Societies, Vol. XII., p. 1.

* Thirty miles of these measurements were made by the writer.

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While it is not the first decision of its kind, the recent ruling of the Supreme Court of New York concerning the paralleling of existing railways by new surface lines is interesting and important, especially when taken in connection with an amendment enacted at the session of the New York legislature just concluded, which strikes out from Section 59 of the railroad law of the state the words: "This shall not apply to street surface railways." In other words, the decision now laid down will apply to the paralleling of steam railways by any surface road, a condition which is now attracting the serious attention of both lawyers and promoters of new transportation enterprises.

This recent decision refers to the Amsterdam, Johnstown & Gloversville R. R. Co., which some time ago sought the permission of the State Railway Commission to build a 14-mile line of railway which would closely parallel the New York Central and three or four other railways. The State Railway Commission refused to grant the desired permission, holding that the public convenience did not require the building of a new railway, which would simply parallel existing roads in a region amply supplied with railway facilities. The company appealed from this decision to the General Term of the Supreme Court, sitting at Albany, and this Court has now confirmed the decision of the Railway Commissioners. The opinion, written by Judge Herrick, turns upon the question of the public convenience and necessity for the new line. The testimony of witnesses sworn in behalf of the application, and the certificates of petitioners, certifying that the road would be a public convenience and necessity, was based upon the alleged exorbitant charges of existing railways, and the belief of the petitioners that the new enterprise would tend to reduce the charges for freight and passengers. Judge Herrick ruled that the charging of exorbitant rates did not, under present law, make a case for the building of another road. Such charges may indicate either that there is insufficient business to support the road with lesser charges, or it may indicate bad management and a grasping disposition on the part of the owners and operators. There is no pretence that there is too much business for the old lines, and the remedy for excessive charges is not in building an opposition road, but it lies in applying to the Railway Commissioners for a reduction of these rates, under Chapter 565, Section 161, of the Laws of 1890. If the new road were built there is no permanent assurance that the alleged ends of the petitioners would be secured. Such a road might cripple those in existence and destroy the value of the investment in them, or it might lead to the purchase of the new by the old company, with prevailing conditions of returns upon the cost of the property worse than before, as far as the public were concerned.

The decision is a sound one, and is doubtless destined to have an important influence upon many trolley enterprises now seeking authority to build under very similar conditions. A fact which has a direct bearing upon the trolley question is that Judge Herrick stated that if it were shown that rates were exorbitant, and application had been made to the Railway Commission for a reduction in such rates, and no redress were obtained, it might be possible to show that the only relief attainable lay in building a new line. In such event, said Judge Herrick, the case would appear before the Court in a very different aspect.

The interesting question would arise, under this view of the case, as to where the line is to be drawn between exorbitant rates and cheaper rates than the steam railway could afford to do business upon. The parallel trolley line could, as a rule, carry passengers and light freight at charges for service below the paying rates of even a well-managed steam railway, and the public has an inherent right to the best service for the least money that can be provided for it. Can the trolley line, encroaching upon the business of an existing steam road, be stopped simply because it can provide cheaper service than is possible with the heavier and more costly equipment of the steam railway, or can the latter be forced down to the local rates of the trolley line? These are interesting questions to both parties concerned, and they are questions upon which our courts and transportation corporations must form an opinion in the near future.

In insisting upon proof that public convenience and necessity require the construction of a new railway before permitting its owners to exercise the right of eminent domain, New York takes the same position that has already been taken by the states of Massachusetts, Maine and Texas. This is a feature in railway enterprise long recognized in England in the exhaustive Parliamentary investigation into the claims for and against new railways; but it is a necessity we are only beginning to realize in the United States. In our wealth of territory and early need of and rush for transportation facilities, the rights of older companies and the interests of the people as a whole have been too long neglected, and are still neglected in many states, notwithstanding the great change in conditions which has taken place.

The International Railway Congress, to be held in London within a few weeks, promises to be a notable gathering, with very useful results to railway interests throughout the world. About 800 delegates are expected to be present; 200 from the railways of the United Kingdom, and the remainder from the rest of the railway world. The managers of the Congress have wisely reduced the reading and discussion of papers and reports at the meeting itself to a minimum. All important documents of this class have been printed and circulated widely during the year past, and the business of the Congress will be confined to handling matter in the concrete, with the detail well digested beforehand. After the manner of the British Association meetings, the Congress will be broken into sections, each with its own chairman; but the conclusions and recommendations of these sections must be submitted to all the delegates before being regarded as sanctioned by the Congress. With the representation promised, and the thorough business-like management seemingly assured, the influence of this Congress should be widely felt for good in all that relates to railway matters throughout the globe. The organization and purposes of the Congress were described in our issue of July 5, 1894.

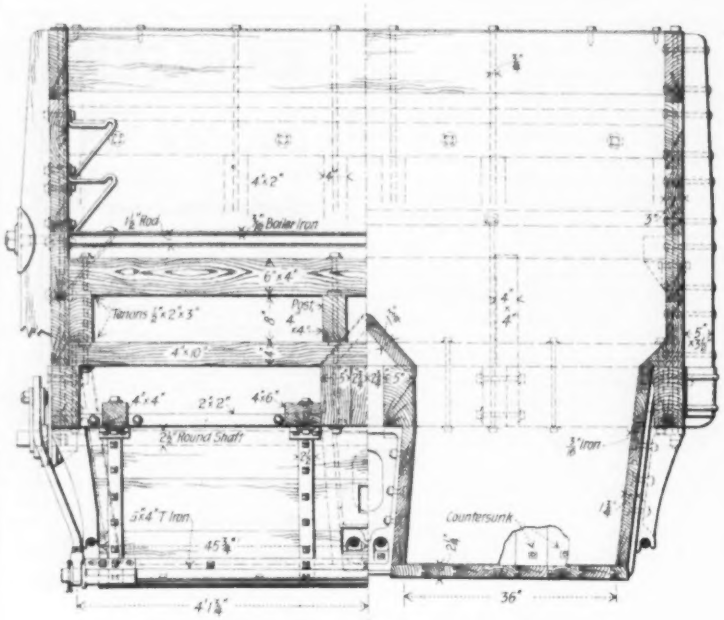
The standard gage for iron and steel sheets which was adopted by Act of Congress March 4, 1893, as "the only standard gage for sheet and plate iron and steel" was formally adopted, we are informed, by the Association of Iron and Steel Sheet Manufacturers and by the Galvanized Sheet Manufacturers on July 1, 1893, and by the Manufacturers of Iron & Steel Roofing on June 1, 1895. On the other hand, a number of the large users of iron and steel sheets seem to generally favor the adoption of some new gage, in which the different numbers shall express the thickness of the metal in thousandths of an inch. The position taken by this party was well stated in an abstract of a report of the committee of the American Ry. Master Mechanics' Association, given in our issue of Jan. 3, 1895. The evils of the present multiplicity of gages are recognized by all, and it is certainly to be hoped that a general agreement on some one gage may soon be reached.

The selection of Mr. John C. Trautwine, Jr., as Chief of the Philadelphia Water Bureau is generally approved by the press of that city; but the "Times," while speaking in the highest terms of Mr. Trautwine, makes the general assertion that civil engineers appointed to public office usually succeed "in making asses of themselves," and says that they are too often self-opinionated, impatient of criticism and prone "to fire off their mouths." Both Philadelphia and New York have had experiences in this field that perhaps justify the remark, but the "Times" goes too far in taking two or three isolated examples of engineers in office as types of a class. Admitting that in an office of this kind executive ability, firmness of character, a cool temper and the knowledge of men go further than the highest professional attainments unbacked by these qualities, it would seem that the practice of civil engineering in any broad field is well calculated to develop these requirements in a high degree. A striking example of the fitness of engineers for official service is to be found in the career of Albert Fink, who, after winning fame as a railway engineer and bridge builder, became one of the keenest of financial diplomats, and revolutionized and for years controlled the traffic management of the most important railways in America. Many other civil engineers could be named who have equally well shown their business capacity outside of the field of professional work; but our Philadelphia contemporary need go no further than the list of presidents and chief officers of the Pennsylvania Railway. John Edgar Thomson, Thomas A. Scott and the present president, George B. Roberts, were all civil engineers for years before they were chosen to the high executive office they all so successfully filled or fill. In short, Philadelphia need feel no apprehension concerning Mr. Trautwine's administration because he is a civil engineer. It should rather congratulate itself upon this coincidence, and the further fact that he is a very level-headed civil engineer.

The explosion of hot water boilers attached to kitchen ranges is such a rare occurrence in this country that the possibility of such explosions is probably not generally appreciated. One main reason why such boilers do not explode is, of course, that there is an open passage from the boiler back into the main, and if the water in the boiler gets so heated that steam begins to form, the effect is merely to force back the water in the supply pipe until condensation of the steam occurs. In a discussion at the recent convention of the American Water-Works Association, it was pointed out that when a water meter is installed on a service, the check valve which is placed near the meter to prevent the hot water running back through the meter and injuring it, removes the safeguard against over-pressure in the boiler, which before existed, and makes possible the overheating of the water and the accumulation of pressure therein to such an extent as to cause a violent explosion. As a safeguard against such accidents, the Hackensack Water Co., which supplies water to Hoboken, N. J., and neighboring cities, has attached safety valves to all kitchen boilers on services where meters are used within its territory, numbering some 12,000.

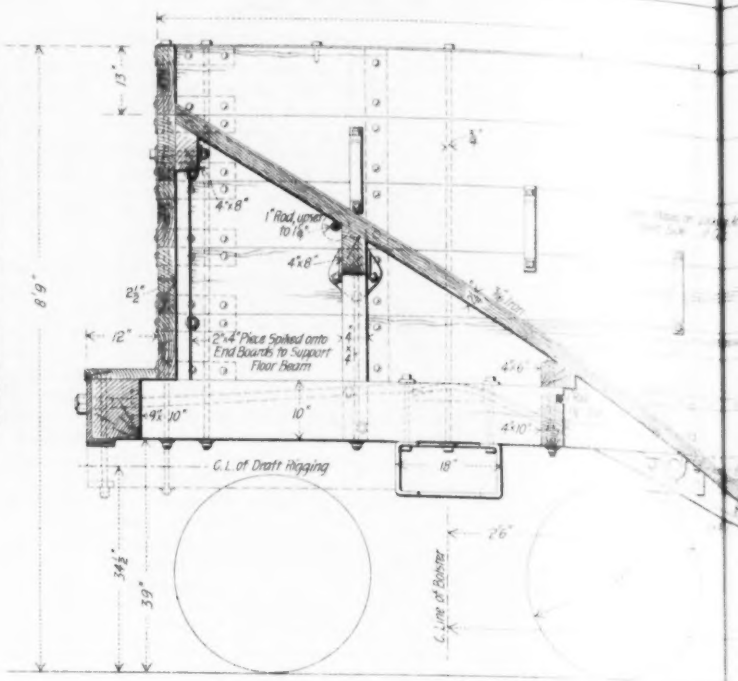
The precaution can certainly do no harm, but so far as our information extends, it has not been generally observed where meters are installed, and no explosions of boilers resulting from over-pressure occurring under such circumstances have ever come to our notice.

In England, on the other hand, the explosion of kitchen range boilers appears to be quite frequent,

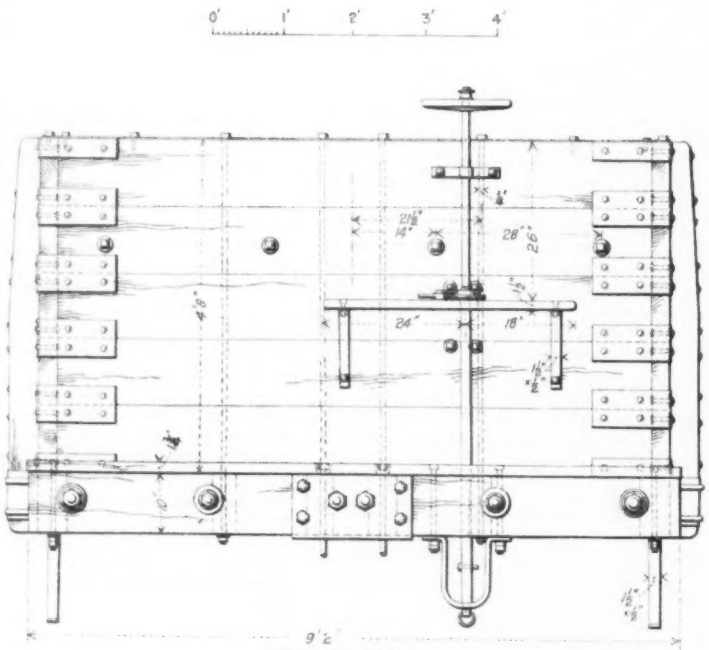


At Middle of Car. | At Bottom of Hopper.

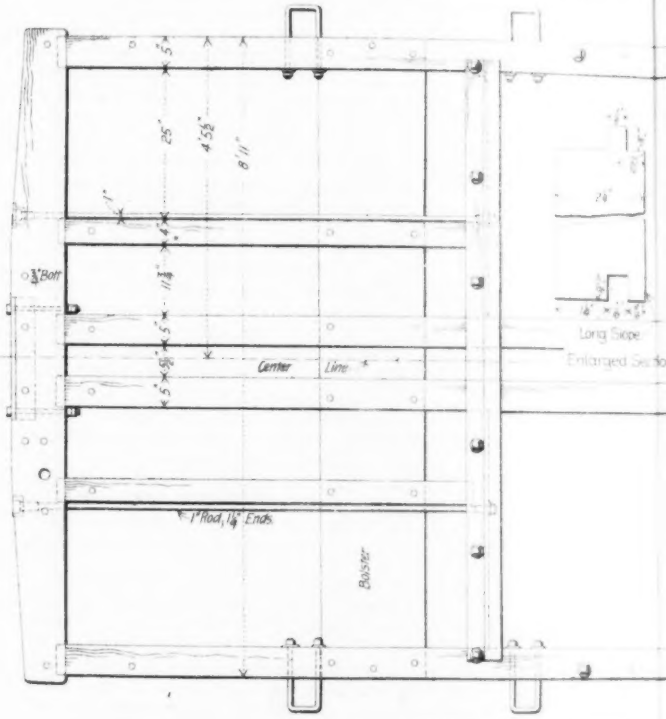
CROSS SECTION.



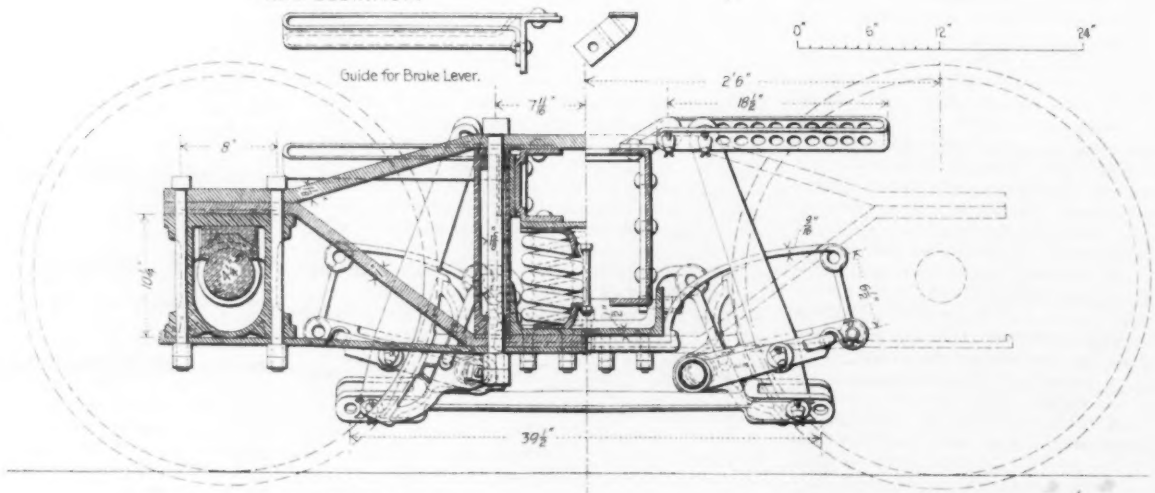
HALF LONGITUDINAL SECTION



END ELEVATION.

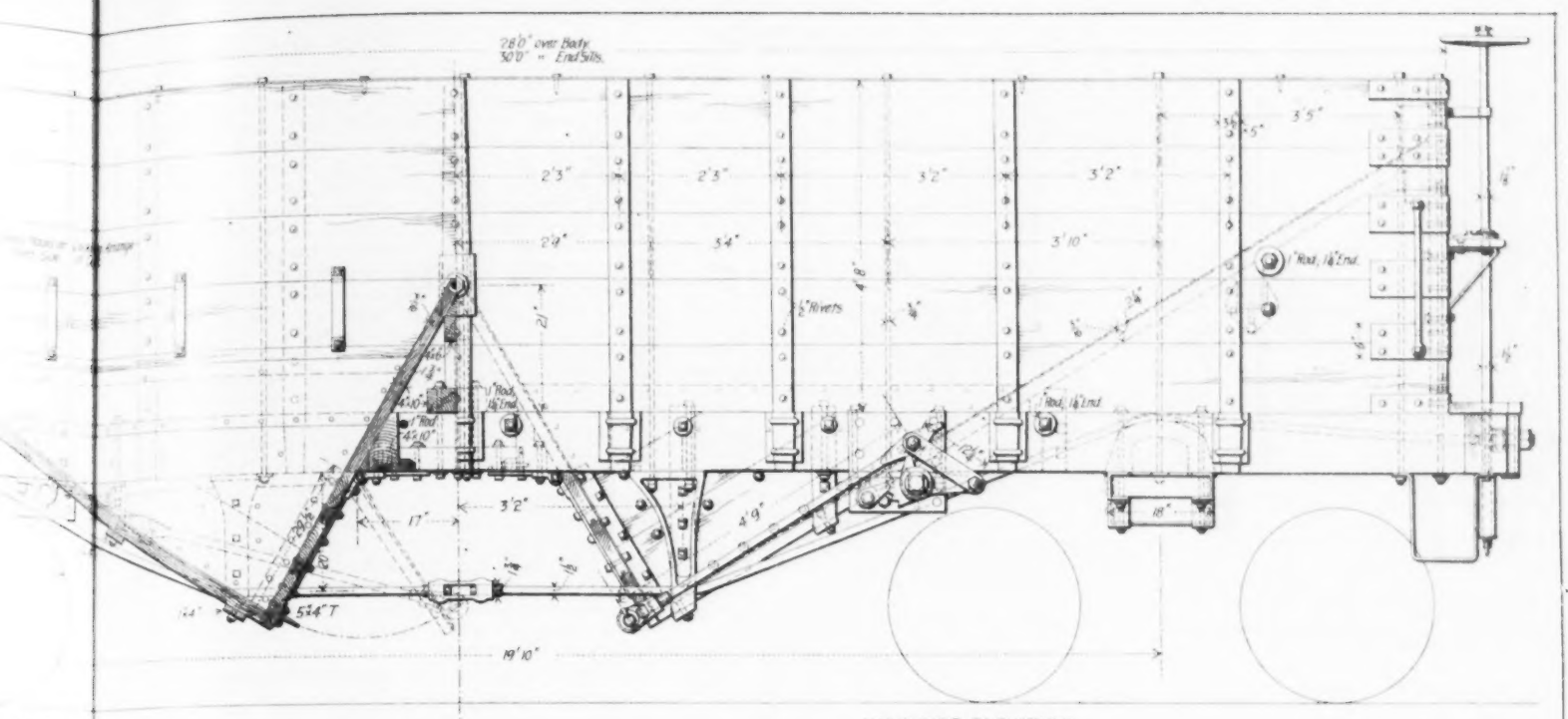


HALF PLAN OF FRAMING.

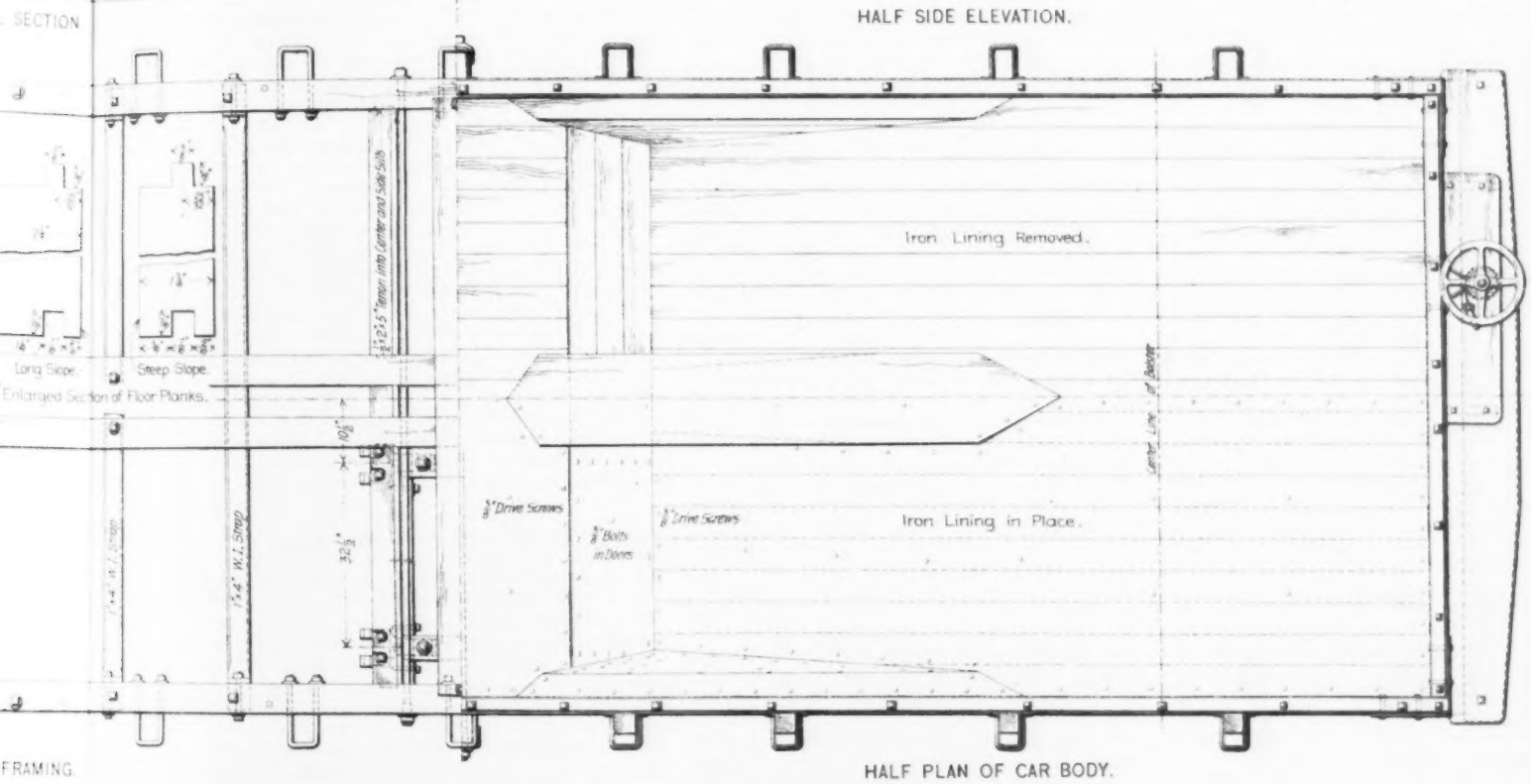


Half Section through Truck Frame. | Half Section through Middle of Bolster.

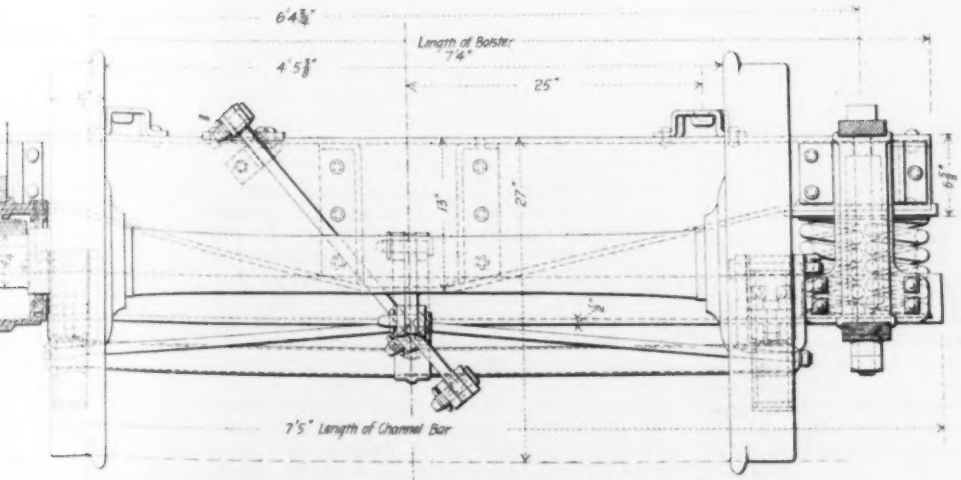
DETAILS OF TRUCK.



HALF SIDE ELEVATION.



HALF PLAN OF CAR BODY.



Half Section through Axle Box.

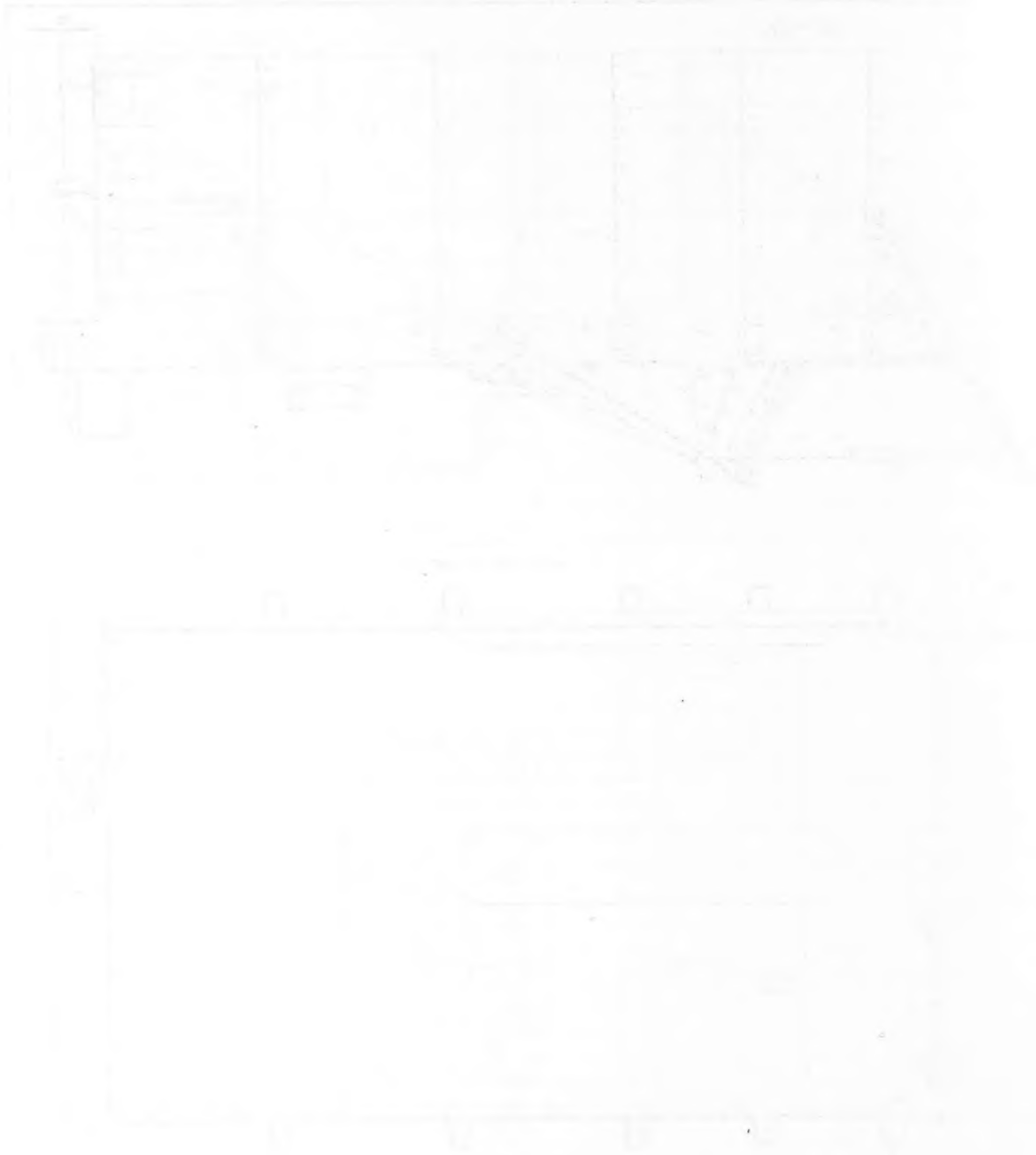
Half Section in Front of Bolster.

NEW 70,000-LB. COAL AND ORE CAR, (CLASS G G.)

Pennsylvania Lines West of Pittsburg.
(Northwest System.)

G. L. Potter, Superintendent of Motive Power.

CHAS. HART & SONS, LITH., 26 VESEY ST., N. Y.



and is especially common in very cold winter weather, when the freezing up of pipes prevents the flow of the water back into the mains in case of over-pressure. It would appear from this that an open passage from the boiler back into the mains is a necessary feature in connection with English range boilers, whether it is in this country or not. The fact may be noted, however, that pressures in English water-supply systems average far below those in this country, and range boilers are doubtless built correspondingly lighter. Thus, in an American boiler built for 150 lbs. pressure, the water in the boiler would have to be heated to much higher temperature before steam would begin to form and the pressure begin to rise than in an English boiler subjected to an ordinary pressure of, say, 30 lbs. This may serve to explain why explosions of range boilers are comparatively rare in this country.

It would be interesting to know whether the practice of the Hackensack Water Co., of attaching safety valves to boilers where water meters are used, has been followed on any other water-works in this country, and whether any range boiler explosions have occurred in this country where meters were used and no safety valves were applied. We shall be pleased to give space in our columns to communications giving information on these points.

The very large class of engineers who are interested in the question of the best paint for structural ironwork will appreciate the article on another page of this issue by Mr. Walter G. Berg, Principal Assistant Engineer of the Lehigh Valley R. R. Some time ago Mr. Berg undertook the preparation of a report to his company covering the much-discussed and disputed questions in connection with painting ironwork. He performed the task with characteristic thoroughness, obtaining a larger mass of information from those in charge of structural work on the principal railways of the country, and from all who by experience were qualified to give information of value upon this subject than has probably ever been collected. The paper printed elsewhere in this issue summarizes the information gathered in this systematic way, and presents the final conclusions which were the outcome of the investigations. The very broad field from which the facts bearing upon the subject were gleaned, and the fidelity and impartiality with which they have been arranged and conclusions drawn from them, make the paper the most valuable, we believe, that has ever been published upon this subject.

The measurement of distances by means of the stadia has come to have a very large application and importance in all extensive surveys covering large tracts. The percentage of error in such surveys, however, has always limited their use, and it will doubtless be a surprise to many engineers to know that by the use of the latest refinements, described in a paper on another page of this issue, it is possible to measure long distances with the stadia with errors of little more than 1 in 2,000. The attainment of such accuracy, moreover, is shown to be quite compatible with rapid work, the writer of the paper having made measurements at the rate of 13 miles per day of 10 hours with an error even less than that above stated. The attainment of such a degree of accuracy will doubtless tend to still further increase the use of the stadia by the engineer in the field.

EQUIPPING FREIGHT CARS WITH AIR-BRAKES AND AUTOMATIC COUPLERS.

Within the short space of 30 months from this time the railways of the United States must complete the equipment of their freight cars with automatic couplers and air-brakes, in order to comply with the law passed by Congress in February, 1893. How great a task this involves can be stated with a fair degree of accuracy. On June 30, 1893, according to the Interstate Commerce Commission's statistics, there were about 1,243,000 freight equipment cars in service, of which about 275,000 were equipped with automatic couplers, and about 240,000 were equipped with air-brakes. How many cars have been equipped in the two years since that time? We need hardly say that no exact statistics on this point are available. The best we can do is to make an approximate estimate from the known facts. During the fiscal year ending June 30, 1892, there were in round numbers 25,000 freight cars equipped with air-brakes, and 73,000 equipped with automatic couplers. In the year ending June 30, 1893, there were about 58,000 cars equipped with air-brakes and about 75,000 with automatic couplers.

Has the rate of progress of 1893 been kept up for the past two years? We consider it very doubtful. During these two years, as every one knows, most railways have been cutting down expenses in every way possible. The building of new cars has been little more than enough to offset the decrease due to the wearing out of old ones. During the year ending June 30, 1894, it is believed that the equipment of cars with brakes and couplers fell to a very low figure. The year just drawing to a close has certainly seen much greater activity in these matters, especially during its latter half; and yet it is unquestionably true that a very large proportion of the railways are still in such financial condition that their officers are doing practically nothing in the direction of complying with the brake and coupler law.

But not to over-estimate the task which the railways of this country have before them, let us suppose that as many as 175,000 freight cars have been equipped with brakes and couplers during the past two years. The number can hardly be materially in excess of this; it seems entirely probable that it is much smaller. Accepting it, however, and also assuming that there has been no increase in freight rolling stock since June 30, 1893, we find that there are at the present day at least 800,000 freight equipment cars with old-style couplers, and about 825,000 without air-brakes.

Turning now to the provisions of the brake and coupler law (published in full in Engineering News of March 2, 1893), we find that so far as brakes are concerned, the law forbids the movement after Jan. 1, 1898, of any train carrying interstate traffic unless a sufficient number of cars in it are equipped with power brakes to enable the engineer to control the speed without requiring the use of hand-brakes.

Interstate traffic, of course, practically includes all freight movement. It would be hard to find a local freight train without some part at least of its lading destined for points beyond state lines. As to how many cars in a train it will be necessary to have equipped with brakes to fulfill the conditions of the law, the number, of course, will vary on different roads; but it will be plain that no railway can be sure of getting its trains made up with sufficient brakes to comply with the law, unless it makes some restrictions upon the acceptance in interchange of the cars of other roads not fitted with air-brakes.

As respects couplers, the law explicitly forbids the use of any car in handling interstate traffic after Jan. 1, 1898, unless it is equipped with "couplers coupling automatically by impact, and which can be uncoupled without the necessity of men going between the ends of the cars." Clearly this provision will compel railways which intend to obey the law to refuse to accept all cars without M. C. B. couplers after the date named.

But it may be said, Is there any likelihood that the law will be enforced? May not the railways safely ignore it, and trust that it may stand on the statute book a dead letter? In discussing this question, we must not forget the state of public sentiment at the present time, and the part which the railway labor element is likely to play in matters like these. The law prescribes a penalty of $100 for each infraction of its provisions, and makes it the duty of any United States District Attorney to prosecute and collect the penalty when information is filed with him. Thus, any one with a grudge against a railway company—any farmer whose stock has been killed, any man with a grievance on account of right-of-way or damage suits, any railway labor union agitator, can put the machinery of the courts in motion to punish the infraction of the law. Clearly, any railway which ignores the requirements of the law will run a very large risk of being mulcted in heavy damages, and having its rolling stock put out of service until the law is complied with.

There are, however, two chances of escaping the penalties imposed. The law may be repealed during the next two years, or if that does not take place, the Interstate Commerce Commission is empowered under the act to extend the time allowed any railway for compliance with the law. How far may either of these contingencies be counted on?

It will doubtless not be disputed that the law was passed against the strenuous opposition of the railway interests. The long trial of strength which took place before its passage was finally secured is still fresh in memory. As every one knows, it is vastly easier to obstruct legislation at Washington than to secure it. Now, if the railways were not able to defeat the present law, it seems evident that they cannot secure the passage of an act repealing it. Whatever political power may rule in Congress during the next two years, we may be very sure that no party manager is so obtuse as to permit his side to be made responsible for the defeat of a law which was enacted at the demand of the railway labor unions.

As for relief at the hands of the Interstate Commerce Commission, that body is already overworked, and some of the applicants for such relief are likely to have to wait some time with their traffic seriously hampered before their case is reached. Moreover, unless a company can show that it has in good faith endeavored to carry out the law from the date of its enactment, its request for relief is extremely likely to meet with a refusal. Even if an extension of time is granted, it is likely to be for a very short period.

Thus, after reviewing each possible contingency, the conclusion seems inevitable that the railways of the country must, within the next 30 months, complete the equipment with air-brakes and M. C. B. couplers of all freight cars used in general interchange, which means the purchase of couplers and brakes for some 800,000 cars.

If any company fails to complete the equipment of its rolling stock within that time, it is likely to find it impossible to use its unequipped cars save for handling local freight solely, on lines which do not cross state boundaries.

Turning now to the technical side of the question, the railways of the country are to be heartily congratulated that the brake "question" and the coupler "question" can no longer be characterized as questions.

The patent litigation of the past three years has apparently definitely settled the exclusive right of the Westinghouse Co. to the manufacture of the quick-action triple-valve, and practically to the manufacture of the entire brake apparatus. The advantages of this outcome in securing uniform design and a uniform standard of excellence are evident to everyone who has studied the air-brake situation. It is fortunate that the Westinghouse Co. takes a broad view of the matter, and, notwithstanding the monopoly which its patents give it, continues to furnish air-brake equipment at prices which are generally admitted to be entirely reasonable. Should it at any time pursue the opposite course, the railways would then have a good reason to urge the granting of an extension of time by the Interstate Commerce Commission, in accordance with Sec. 7 of the law. The possible inability of the Westinghouse Co. to supply the demands upon it during the next two years would also be good cause for such an extension.

In the matter of couplers, if the state of affairs is less satisfactory than in the matter of brakes, we can congratulate ourselves that it is vastly more satisfactory than was the case a half-dozen years ago, when the practical success of the M. C. B. coupler was still uncertain, and many interests mustering no small strength and influence were combined to defeat its success. The experience of nearly eight years has now shown that the M. C. B. coupler, when well made, of good material and of proper design, actually costs much less in the long run than the old link and pin coupler, to say nothing of its merits in the saving of lives and limbs, and the great advantage which it possesses in handling long trains.

The need of good material in coupler manufacture is more familiar to all railway officers in charge of rolling stock, and now that car owners are to be made responsible for the repairs on their cars, the need of purchasing couplers under strict specifications and tests is more than ever apparent.

As for the design of couplers, we speak within bounds when we say that the greatest need to-day is uniformity. When the M. C. B. coupler was first adopted, it was supposed that simple conformity to certain contour lines adopted as standard would fulfill all requirements. Experience in recent years, however, has shown that while uniform contour lines which enable each coupler to lock with any other coupler are a necessity, very great advantages would be gained if the coupler could be made uniform in many other features. If there are 20 different kinds of coupler in service, then at every considerable interchange point a considerable stock of extra parts must be kept of all these 20 different kinds, in order to make repairs without either needless expense or long and vexatious delays.

But uniformity is not only desirable as a measure of economy. It materially facilitates the work of the yardmen, and contributes in no small degree to their safety. The desire of each coupler manufacturer to have some special feature for which he could claim superiority has led to a deliberate attempt to seek variety rather than uniformity in the details of the coupler where variation is possible, especially in the unlocking and knuckle-opening gear. Now not a small part of the work in busy yards is done at night, and even by day most of the different makes of M. C. B. couplers resemble each other so much as only to be distinguished by a close inspection. The yardman who is dodging around with a dim lantern, cutting a train here and making a coupling there, has no time to spare to study out how this or that unlocking gear or knuckle-opening device operates. He grasps a handle and jerks it this way and that, until something moves or gives way.

Those who are familiar with the work about our busy terminals are aware that yardmen would rise up and bless the day that saw all unlocking devices made absolutely uniform, and all levers and contraptions for opening the knuckles done away with. As a matter of fact, there is only an infinitesimal risk involved in opening the knuckle by hand, and no risk whatever unless the man, through deliberate carelessness, waits until the moving car is close upon him before opening the knuckle. On the other hand, if he attempts to open the knuckle by the lever, and the apparatus sticks or he fails to give it the correct motion, he may then be so delayed that when he finally reaches it to pull the knuckle open with his hand, the moving car is upon him.

Uniformity and simplicity, then, are matters to which close attention should be paid by railway operating officers in completing the equipment of cars with M. C. B. couplers, and it is greatly to be hoped that the development of the next few years may be in this direction more than has been the case in the past.

The investment involved in the equipment of 800,000 cars with brakes and couplers during the coming 2½ years amounts, of course, to an enormous sum. On the other hand, the reduction in cost of iron and improvements in manufacture have nearly halved the cost of couplers, compared with what it was a half-dozen years ago. And it was pointed out in these columns years ago, what experience has since well proved, that the investment in brakes and couplers is an investment which returns good interest to the railways in lessening the cost of repairs, reducing the number of accidents and largely increasing the efficiency of rolling stock and train service.

LETTERS TO THE EDITOR.

A FREIGHT WRECK ON THE BIG FOUR.

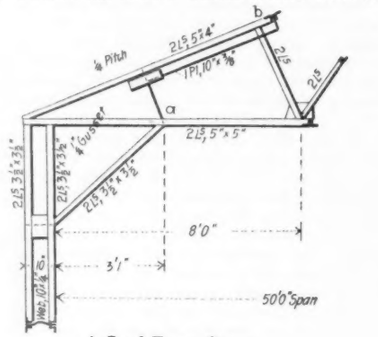
Sir: The Peoria division of the Cleveland, Cincinnati, Chicago & St. Louis suffered another wreck at this place this morning at about 7:30, the facts of which are as follows: The yard engine was engaged in switching near the western limits of the yards and was occupying the main track with ten cars coupled ahead of it, just preparing to take the siding to clear the way for a freight train coming in across the bridge about 2,000 ft. west of the depot, the same that was wrecked by a freight collision on Aug. 6, 1893 (Eng. News, Aug. 24, 1893). The freight train coming in was composed of 31 loaded cars and the caboose, and it ran across the bridge under a full head of steam in order to ascend the grade and round the curve between the bridge and the yard. In the hurry to make the siding the first car was pushed past the points of the switch before it was opened, or jumped the track from some other cause, and the incoming engine collided with the tender of the yard engine, both heavy freight engines. As a result of the collision, two cars just in front of the yard engine were thrown aside to the left and landed side by side clear of the track right side up, somewhat broken. The two forward cars were pushed six car lengths onto the switch and stopped in a position diagonal with the track. The tender of the second engine reared up behind and telescoped the first car of the freight train, raising the roof and pushing some of the fire-brick with which it was loaded through the rear end and scattering them along the track for seven car lengths before the train came to a stop. The damage suffered by the engines was comparatively slight, being covered by damage to the two tenders, cow-catchers and the left-hand cylinders. No one was hurt.

Danville, Ill., May 29, 1895. • • •

("The more haste the less speed," says the old proverb. The value of fixed signals to protect trains using the main track within yard limits has been well attested by long experience. The cost of their installation and operation, moreover, is so small that the plea of expense can hardly be entered as a reason not using them.—Ed.)

CONCERNING A ROOF TRUSS.

Sir: I should like to know whether a construction in



A Roof Truss Query.

a roof truss as shown in accompanying sketch is to be called waste of material or ornamental work?

Very respectfully, Chas. Steiner,
116 Catherine St., Elmira, N. Y., May 15, 1895.

(Our correspondent apparently thinks that if the gusset plate is used there should also be a connection from a to b.—Ed.)

PAINT FOR METAL STRUCTURES.

Sir: Referring to Mr. Emil Gerber's reply in your correspondence columns to the remarks by the undersigned on Mr. Gerber's treatise, the writer would heartily agree with Mr. Gerber on the importance of properly preparing metal surfaces for the application of paint. There is such practical unanimity upon the necessity of adequate preliminary work that in the discussion of paints it is taken for granted that such work has been done. This preparation is the feet; the paint the boots; some kinds protecting and some not.

If Mr. Gerber believes the criticism to be from the standpoint of the red lead manufacturer, it might also pertinently be urged that much in his paper expresses the views of the maker of oxide of iron paint.

Yours truly, Ralph K. Wing.

1 Broadway, New York, June 3, 1895.

RELATION BETWEEN CYLINDER TRACTIVE POWER AND WEIGHT ON LOCOMOTIVE DRIVERS.

Sir: Can you explain to me the cause of the great irregularity existing in the relation between the weight on the drivers of locomotives of the same type and the traction as obtained from the steam pressure, size of cylinders and diameter of drivers?

Assuming that the traction should be one-fourth the weight on the drivers, the percentage of the boiler pressure that must be used to obtain this varies all the way from 78 to 98 in cases that I have noted. With any other proportion, although the actual percentages would be different, there is, of course, the same variance. Where larger driving wheels are used, it would indicate that speed instead of traction was desired, and great difference in the boiler pressure might cause some change in the percentage, but here are two consolidation locomotives by the same builder:

Dimension of cylinder.	Boiler pressure.	Diameter of drivers.	Weight on drivers.	Per cent. boiler pressure.*
19 × 24 ins.	150 lbs.	50 ins.	100,000 lbs.	96 %
22 × 28 "	150 "	50 "	134,000 "	82½ "

* To develop a traction of one-fourth the weight on drivers.

The heavier of these two engines would seem to be about the right proportions, but it certainly seems that the other should have larger cylinders, as it could not be expected that so high a percentage of the boiler pressure would be obtained for the mean effective pressure in the cylinders. Yours truly,

Philadelphia, May 14, 1895. Engineer.

(Locomotive building shops turn out most of their product in accordance with detailed plans and specifications furnished by the purchasers. The disparity in the feature referred to by our correspondent is due to the variety of opinions prevailing among Superintendents of Motive Power and Master Mechanics as to the proper relation between cylinder power and adhesion. Kent's new pocket-book gives as a "common builder's rule" for determining the piston diameter, the following:

$$\text{Piston diameter in inches} = \sqrt{\frac{0.25 \times \text{dia. of drivers in ins.} \times \text{Wt. on drivers in lbs.}}{0.9 \times \text{steam press. in cylinders} \times \text{stroke in ins.}}}$$

According to this formula the first engine in the above table should have a cylinder 19.6 ins. in diameter, and the second should have a cylinder 21 ins. in diameter. Strictly speaking, a locomotive cylinder should be proportioned for the class of work the locomotive has to do. An engine for switching service or local freight use should have its cylinder power kept down to a point where the wheels will not be slipped in starting; in an engine for hauling through freight, the cylinders should be proportioned to give the desired tractive power with the most economical use of steam.—Ed.)

E. M. N.'s request for information as to sand-washing machines is answered by Mr. Ellis B. Noyes, of Portsmouth, Va., who refers to the Superintendent of the Juniata Sand Quarries at Lewiston, Pa.; and by Mr. A. B. Pomme, of Herkimer, N. Y., who states that a machine is in use on the Ilion, N. Y., water-works, designed by a member of the Board of Water Commissioners of that town. Mr. Walter M. Stein, of 325 Walnut St., Philadelphia, Pa., also writes that he can furnish information on the subject.

M. H. M. asks for a work on city surveying showing how to find street lines where there are no monuments to measure or range lines from. The chapter on "City Surveying" in Professor Johnson's "Theory and Practice of Surveying" contains some common-sense instructions which may be of service to our correspondent.

PAINTING IRON RAILWAY BRIDGES.

By Walter G. Berg.

In the course of his professional duties, the writer was recently required to prepare a report on the subject of best paints and methods for painting iron bridges, viewed from the standpoint of a railway engineer. While admitting that the general use of any article or method is not absolutely indicative of its superiority over other less well known or established articles or methods, the fact of such general use is strong presumptive evidence in its favor, and hence the question of the prevailing practice received considerable attention. Direct inquiries were made of a very large number of prominent railway and government officials as to their views and practice, supplemented by an examination of articles on this subject in the technical press and association reports, and personal interviews and correspondence with paint manufacturers and chemists. The publication of the information furnished by the chief engineers of about 30 of the prominent railway systems of the country, together with the practice of the U. S. Navy, Ordnance, Engineer and Lighthouse departments, would prove one of the most valuable contributions of the day on this subject, but, owing to the privileged character of the communications, the writer can only present for publication his personal deductions and conclusions, as contained in the following extracts from his report:

Discussion of Principal Classes of Paints Suitable for Iron Bridges.

The paints most commonly used for painting iron-work, especially with reference to the priming coats, can be classed in general as follows:

1. Metallic or iron paint, consisting of oxide of iron and linseed oil.
2. Red lead paint, consisting of red oxide of lead and linseed oil.
3. Asphalt paints, consisting of mineral and artificial asphalts or coal tar, alone or combined with each other, and frequently mixed with metallic bases, oils and other materials.
4. Carbon and graphite paints.
5. Patent paints.

White lead or white lead and zinc mixtures are not considered suitable for the priming coats on iron. But, where a light finishing color is desired, the use of white lead, or white lead and zinc, ground in linseed oil, with the addition of a suitable tinting material, is necessary.

The use of light-colored paints, the superiority of which, as claimed by the manufacturers, consists in the preponderance of dark-colored bases, such as asphalts, carbons, red oxides, etc., is not warranted, as the lighter the shade desired, the larger the quantity of foreign light-colored pigment that has to be used to counteract the dark color of the base, thus diminishing the amount and destroying the advantages, if any, of the much-advertised "base."

Ochre paints, as recommended by Dr. Charles B. Dudley, Chemist of the Pennsylvania R. R., and also as used by the U. S. Ordnance Dept., have not been extensively tried on bridgework, as far as known.

In considering the recommendations, recorded results and opinions on the subject of paints, special attention must be given to the fact, that the requirements of a paint for iron or steel bridge structures exposed to the atmosphere only, are different from preservative coatings for wood, underground pipes and ship bottoms, and that further the variations in climatic influences and exposures at different localities, and the varying methods of application of the paint tend to make a critical comparison very difficult.

1. Metallic or Iron Paints.—This paint is made of oxide of iron ground in linseed oil. The oxide is either the ground natural iron ore, or is an artificial oxide, prepared by roasting the ore. The makers furnish it in powder or in paste form, ready for mixing with oil. If bought in powder form, properly tested, and then mixed with pure oil in a small hand or power mixer in the railway company's paint shop, adulterations should not be possible, and good results will be obtained.

It is these adulterations and improper applications that have caused so much to be said and written against iron paints. Unfortunately, it is a fact that any paint put on the market under the name of "iron" or "metallic" or some similar cognomen, is considered to be all right, and to possess all the qualities of well-known pioneer brands, which have established the reputation of iron paints. The tendency of the age seems to be to accept without question, and natural iron ore or adulterated artificial iron oxide, fairly well ground, mixed with so-called linseed oil, and sold under some euphonious trade name at about the price of pure linseed oil. The chief merits of oxide of iron paint would seem to be that it is comparatively cheap, has been used for a long time, and has given many proofs of its usefulness for a variety of purposes, when unadulterated and mixed with pure linseed oil and properly applied.

Fifteen or twenty years ago the almost universal practice for bridge painting was to use "iron paint." On investigation it will be found that to-day its use for bridge work is continued mainly only on small roads and on roads where the first cost predominates all other considerations; but, as a rule, large systems have been experimenting for the last decade or longer with red lead, asphalt or patent paints. The extensive use of iron paint to-day on the rolling stock of railways, on wooden structures, for house painting, and frequently for finishing coats of bridges, or for repainting bridges previously painted with it, all speak in its favor as a cheap paint possessing considerable merits for certain conditions. The existing weight of opinion and prevailing practice, however, is certainly steadily setting in against its use for the priming coat of iron structures.

This step has been reached largely owing to the constantly advanced argument by scientists, chemists and practical painters, that iron paints applied to iron and steel surfaces are PROMOTERS of rust instead of PREVENTERS. The claim that oxide of iron per se is nothing but "iron rust," is a common fallacy that practical men seem to hold. That oxide of iron, however, under certain conditions in combination with linseed oil becomes a carrier of oxygen to the iron surface underneath it, thus, in connection with moisture, forming rust, seems to be an indisputable fact. But there is no doubt that the use of inferior pigments, adulterated oils, and especially improper application to dirty, greasy, rusted, moist or mill-scaled iron surfaces have had more influence in condemning it for iron paint than theoretical and chemical arguments and deductions.

In other words, a suitable grade of iron oxide, unadulterated by subsequent mixtures with injurious so-called inert pigments, and free from sulphur, acids and other deleterious chemicals, mixed with a perfectly pure quality of suitably prepared linseed oil, applied in warm, dry weather to perfectly clean iron, free from rust and mill-scale, and followed up in due time by an additional coat or coats of the same material, will give very good practical results for iron bridges, entirely commensurate with the cost of the paint, in spite of the theoretical and well-proved arguments against the use of iron paints in general for priming iron. But in actual practice this ideal material and method of application can hardly be relied on in the long run, owing to the great temptation offered and the prevailing tendency of the purchasing and administrative departments of a railway to judge the quality of materials and workmanship by the question of cost.

With improper materials and especially defective application, the theoretical and chemical defects of iron paints in oil become more apparent and serious. Hence, the conclusion that iron paints should, as a general axiom, be excluded for priming iron and steel surfaces seems perfectly warranted from a practical standpoint, although with pure materials, properly ground, mixed and applied on perfectly clean iron, or used as a finishing coat, the serious results prognosticated by many writers and eminent authorities on the subject will not be realized.

2. Red Lead Paint.—This paint is made of the red oxide of lead, mixed with linseed oil. It is invariably furnished by the makers in powder form, as it sets quickly when mixed with oil, and hence has to be mixed shortly before use.

The color is a bright red, which is not objectionable for priming coats; but for finishing coats the color is changed to a deep chocolate or a very dark-brown black by mixing with it a small amount of lampblack, which is in itself one of the best known and most valuable inert pigments, and hence in no way objectionable. There seem also to be good reasons for adding lampblack to the priming coat, as it prevents the red lead setting too quickly, which is a practical advantage in working the paint. Some railways use graphite for toning down the red lead in place of lampblack.

The chief reasons to-day in favor of the red lead paint would seem to be that its use is becoming very general for railroad bridge painting, especially for priming coats, and, after toning down with lampblack or graphite, also for finishing coats, wherever light-colored finishing coats are not called for. It is nearly as cheap as oxide of iron paints, if its greater covering capacity, as claimed by the manufacturers and a great many users, is considered; while, on the other hand, it becomes as costly as any high-priced paint on the market, if a low average covering capacity is assumed. On this point the statements are most conflicting. The manufacturers claim a covering capacity of from 750 to 1,200 sq. ft. The results of painting about 3,000 lin. ft. of bridging on the St. Louis & San Francisco Ry. would seem to be about 400 sq. ft. for the first coat, and about 1,000 to 1,100 sq. ft. for the second coat. The fact of the adoption of red lead on such a large number of railways, however, certainly seems to indicate that its covering capacity and price, with the practical results attained, must be favorable, as compared with the cheaper iron oxide and asphaltum paints which it replaces.

As to adulteration, it can be said that the quality of the pigment, which has to be purchased in powder form, can be readily tested by simple tests, and that in the paint trade it is considered that red lead bought of the large manufacturers, not of middlemen, can be relied on for purity. In other words, there is less chance for adulterations to exists than in purchasing ready-mixed patent or iron paints.

On the other hand, manufacturers of rival paints and others present the following arguments against the use of red lead:

That the fact of its increasing use for bridge painting is not absolutely indicative of its superiority, as this remarkable interest for red lead has been awakened "artificially" by extensive advertising, great activity of local and traveling representatives, and other means resorted to by the "Lead Trust."—After examining the statements and extracts collected in connection with this report and considering the different classes of officials and writers on the subject, who would have to be unduly interested, the claim that the general enthusiasm on the subject is artificial is not warranted.

That the fact that red lead is a drier in itself causes it to oxidize, i. e., dry, the linseed oil so rapidly as to burn it, i. e., exhaust its vitality, owing to the thorough chemical combination entered into between the lead and the oil.

That red lead will set in the bucket, while being used. But there is abundant practical evidence that when mixed with lampblack in paste form it can be kept for quite a time, and that, even when fully mixed with oil, it can be kept for a reasonable time before using it, if agitated from time to time.

That the extensive use of red lead for ship bottoms in Government work is not indicative of its usefulness for bridge painting, as the exposure is entirely different, and the sea water helps to kill the excessive drying tendency that red lead has on the oil, and thus removes one of the principal objections to the use of red lead in the air.

That red lead does not work well alone, especially the first coat being liable to run badly on slanting or vertical surfaces.—From several statements and authorities the tendency to run would seem to be largely eliminated when the red lead is mixed with lampblack or graphite, or by adding a little japan. It is admitted, however, that, especially in the first coat, the tendency of red lead on slanting surfaces to run has some foundation, and is one of the most serious practical objections to its use.

3. Asphalt Paints.—The term "asphalt" is unfortunately made use of in the paint trade to cover a multitude of mixtures, consisting of mineral and artificial asphalts or coal tar, alone or combined with each other, and frequently mixed with metallic bases, oils and other materials. These paints are invariably sold mixed ready for use.

The success of pure asphalt preparations and even coal tar mixtures, under certain conditions and for certain classes of work, especially when applied hot or partially baked after application, caused the impetus for the extensive introduction of similar paints on structural ironwork with more or less beneficial results, according to the pureness of the article, and probably more particularly the method of application.

The principles governing the use of asphalt for paints are no doubt correct, and mark a step in advance of iron and lead compounds, and would seem to eliminate the perplexing questions relating to the destructive oxidation, the chemical activity, and the galvanic and electrical phenomena connected apparently with the use of metallic compounds. The tendency in the paint problem to-day seems to be in the direction of the adoption of chemically and electrically inert pigments, combined with suitable vehicles, forming a coating unaffected by outside influences and impervious to moisture and gases.

A properly constituted pure asphalt paint (not a coal tar, benzine and mineral or fish oil mixture) would seem to be worthy of extensive trial, especially for priming iron. Cheap so-called asphalt or asphaltum paints are not included in this recommendation, as the price of the article excludes pureness. This fact, combined with the uncertainty as to what the cheap mixture really contains, makes it preferable (if a cheap paint has to be used) for the purchaser to buy, at the same cost, or generally even at less cost, iron oxide powder and pure linseed oil, and have the mixture made under his own supervision.

The black shades of asphalt paints are the only ones that should be used in any event, if the inherent value of the paint is to be considered as vested mainly in the "asphalt."

A comparatively modern asphalt preparation, known as "black bridge paint," made by the old house of Edward Smith & Co., New York city, seems to have good prospects, being very well spoken of by prominent chemists. The analysis made by a railway chemist showed the paint to contain asphaltum, linseed oil, turpentine and Kauri gum. This paint has a varnish or japan-like finish and luster, and represents a new departure in bridge painting—namely, the introduction of a varnish-like finish and consistency in a bridge paint, offering a much more impervious coating than the ordinary oil paints. The principles followed in the preparation of this paint certainly recommend it

very highly, and it only needs some additional successful tests to bring it very prominently forward. The manufacturers recommend that the paint should be used as thick as feasible, covering only from 300 to 500 sq. ft. one coat per gallon of paint. Of course, it can be thinned by turpentine and brushed out to any extent desired, but with a corresponding loss of durability.

4. Carbon and Graphite Paints.—The manufacturers of carbon and graphite paints proceed on the correct principle that the paint should be chemically and electrically inert, when applied to iron or steel surfaces. Graphite is one of the forms of carbon, hence is classified with the so-called carbon paints; but whether the latter are also composed of graphite or else compounds of lampblack or other materials, is uncertain without chemical analysis, owing to the reticence of the makers on the subject. There are several kinds of graphite—the granular and the flake graphite. Graphite does not absorb or act chemically on linseed oil, so that the vehicle serves simply to bind the particles of the pigment together. To hasten the drying of the paint, boiled linseed oil has to be used.

Lampblack is a great absorbent of linseed oil, and is one of the best inert pigments known.

Owing to the light specific gravity of carbon and graphite compounds, it is claimed that the resulting paint brushes out very well, spreading easily, and shows a large covering capacity. The thickness of the coat is naturally reduced correspondingly, which, however, the manufacturers usually claim is an advantage.

The Dixon Graphite Crucible Co., of Jersey City, use a flake graphite, combined with silica. The Detroit Graphite Manufacturing Co. use a graphite material mined in Michigan, which is in reality a mineral ore with a large percentage of graphitic carbon in granulated form. The Michigan Central R. R. use the natural graphite mineral ore of the Detroit Graphite Co. mixed with red lead, and are experimenting with the graphite alone. The Missouri Pacific R. R. use graphite for toning down red lead, and also use it alone for finishing coats. There is a carbon paint, manufactured by the Sherwin-Williams Co., of Cleveland and New York, which is used by the Lake Shore & Michigan Southern and other railways. A carbon paint, manufactured by Burtis, Patterson, Sargent Co., of Cleveland, is being tried on some railways.

5. Patent Paints.—There are numerous patent paints or varnishes for protecting iron and steel, which, owing to their composition being practically a secret, cannot be grouped with the preceding classes. In purchasing these paints, the same as with all ready-mixed paints, it is essential to deal only with firms of the very best standing, and then only after satisfactory results from large size tests have been obtained.

One of the patent paints that seems most worthy of extensive trial is the "Bessemer" paint, manufactured by Messrs. Rinald Bros., of Philadelphia. It is used by the U. S. Ordnance Department at Sandy Hook with very good results. The chief engineers of several prominent railways have tried it, and speak well of it. Elaborate certificates from eminent German chemists also demonstrate its merits. The manufacturers claim that it is not a graphite, asphalt or carbon paint; it should be called a "compound mineral" or, better, simply "compound" paint. They claim it is chemically and electrically inert, together with all the other virtues that a good paint should have. From information obtained from other sources, it would seem that the "Bessemer" is a linseed oil paint, containing a little gum, the pigment being ground slag from the basic Bessemer furnaces. The general opinion of users of this paint seems to be that it is a very superior article, but high priced and slightly more difficult to apply than ordinary paints.

Cost of Paints.

The cost of sundry paints is about as follows, in general, compiled from the best data available:

Oxide of Iron (Prince's Metallic Brown).

One gallon of paint contains:

6¼ lbs. mineral, at 1 ct.	6 cts.
6¼ lbs. raw linseed oil—5-6 gallon—at 56 cts.	47 "
Cost of materials per gallon of paint	.53 cts.

Red Lead (National Lead Co.).

One gallon of paint contains:

20 lbs. red lead, at 5 cts.	$1.00
5½ lbs. raw linseed oil—¾ gallon—at 56 cts.	.42
Cost of materials per gallon of paint	$1.42

White Lead and Zinc Finishing Color (Devoe & Co.).

One gallon of paint in raw linseed oil mixed ready for use costs about $1.10.

Graphite (Dixon Graphite Co.).

Five pounds graphite paste and 1 gallon oil make 1⅛ gallons of paint.

3¾ lbs. graphite paste, at 12 cts.	45 cts.
¾ gallon boiled linseed oil, at 59 cts.	44 "
Cost of materials per gallon of paint	89 cts.

Sherwin-Williams Co.

Light shades of white lead and zinc mixtures, one gallon, mixed ready for use, costs $1.25. Dark red shades (metallic paints), one gallon, mixed ready for use, costs 75 cts.

Carbon Primer (Sherwin-Williams Co.).

Carbon primer, one gallon, mixed ready for use, costs $1.50.

Black Bridge Paint (Edw. Smith & Co.).

Black Bridge paint, one gallon, mixed ready for use, costs $1.25.

"Bessemer" Paint (Rinald Bros.).

Bessemer paint, one gallon, mixed ready for use, costs $1.50.

"Superior Graphite" Paint (Detroit Graphite Manufacturing Co.).

Superior graphite paint, one gallon, mixed ready for use, costs $1.10 bought in large lots.

The regular cost of the general run of cheap ready-mixed paints of the iron-clad, iron-oxide and so-called asphaltum grades is about 60 to 75 cts. per gallon, mixed ready for use. Special lower prices are offered to large consumers and to the trade.

The manufacturers of paints, especially of some of the high-priced grades, make large claims for the extra covering capacity of their goods. The information at hand on this score is most conflicting. The actual results will vary with the condition of the surface to be painted and whether the coat is a priming or a finishing coat. The cost of labor will also vary slightly with different paints.

The following table is based on assumed covering capacities, gathered from statements of manufacturers and others. It can serve somewhat as a guide for comparing the unit cost of paints, but is not considered as presenting very reliable data, as the assumed covering capacities in some cases are excessive or extreme limits, not practical averages, while in other cases the manufacturers have given lower but more probable limits.

Kind of paint.	Cost, per gallon.	Assumed covering capacity of one gallon (one coat), sq. ft.	Cost of materials for 100 sq. ft. (one coat), cts.
Oxide of iron (Prince's)	$0.53	600 to 700	9 to 7½
Red lead (National Lead Co.)	1.42	750 " 1,200	19 " 12
White lead and zinc (Devoe & Co.)	1.10	400 " 500	27½ " 22
" " " " (Sherwin-Williams Co.)	1.25	600	21
Metallic (Sherwin-Williams Co.)	.75	450	16½
Graphite (Dixon's)	.89	500 to 600	18 to 15
Superior graphite (Detroit Graphite Mfg. Co.)	1.10	600 " 800	18 " 14
Carbon primer (Sherwin-Williams)	1.50	1,000 " 1,500	15 " 10
Black Bridge paint (Edw. Smith & Co.)	1.25	300 " 500	42 " 25
Bessemer paint (Rinald Bros.)	1.50	600 " 1,000	25 " 15

Essential Elements and Conditions for Securing Good Results.

The following are the essential elements and conditions for securing good results with bridge paints, exposed to the ordinary deteriorating influences existing along the line of a railroad.

Preparation of Iron Surface.—It is probably an indisputable fact that the improper preparation or condition of the iron or steel surface to be painted has caused more individual failures, or reported inferior results of bridge paints, than any other cause connected with the process of painting. Particular emphasis is laid on this point by every authority and writer on the subject in the technical press and association reports. Every specification for bridge painting prescribes what shall be done in the matter. Every bridge painter claims that he puts the iron surface in proper shape before applying paint.

Nevertheless the same carelessness in this respect continues in actual practice, especially on structural work painted at shops before shipment. The causes for this neglect are not necessary to discuss here. The fact remains.

Pages and pages of extracts from opinions and reports on this subject could be quoted to lend additional weight to the conclusion reached—namely, that the improper application of paints to dirty, greasy, rusted, chilled, moist or mill-scaled iron is responsible for most failures of the average run of good bridge paints.

If the present report should have no other results than to cause greater care to be given to the proper preparation of the iron surface before applying paint, then one of the most important steps in the matter of improving the lasting qualities of bridge paints will have been secured; in fact, more than one-half the battle will have been won. In other words, a report on "The Best Bridge Paints for Iron Surfaces" could very appropriately be entitled, "The Best Iron Surfaces for Bridge Paints."

The evil being known and acknowledged, the next step is to secure the proper remedy.

The most essential feature is to attach to the "paint question" the same importance not only on paper, but in the actual inspection and supervision of the work, as is given to the minutest structural details.

This cannot be accomplished by simply issuing orders to bridge gangs, or adding clauses to contract specifications. It requires the most determined stand on the part of the men in actual charge of work. First, they must be educated to understand the importance of the question, and then given to realize that they will have the absolute support and backing of their superiors in any stand they take against perpetuating the so-called practical methods of many railroad bridge painters and the general daubing applied indiscriminately by common laborers under instructions of unscrupulous contractors. If the superiors do not understand the importance of the proper preparation of the iron surface, and do not give it the same actual consideration and care as other matters, it will be next to impossible for the inspector or supervising official to enforce good work.

Where painting is done by the railway company's men, the importance of the proper preparation of the surface before painting should be rigidly insisted on and carried out, independent of the effect on the payroll. Once start gaging the efficiency of a paint foreman solely in inverse ratio to his payroll, and all the studies and reports of scientists, specialists and engineers on the subject of bridge paints are practically to a large extent valueless.

For contract work, especially for the priming coat before leaving the shop, a distinct written understanding on the importance of the subject prior to the award of the contract, backed up by actual constant inspection, is the only plan that will remedy existing defects.

In the majority of cases there is no regular bridge inspector, or he is so crowded with miscellaneous duties, that the inspection of the painting becomes a farce. In such cases it is quite customary to prescribe that the iron shall be painted with linseed oil before leaving shop. This enables the condition of the iron to be examined after delivery at the bridge site and before final painting, without necessitating special shop inspectors. One of the objections to this method is that the oil will collect grit in course of handling and transporting the iron. Another objection seems to be the partly theoretical one, that the first coat of oil will create a superfluity of oil when paint is placed on top of it, and the adhesion of the paint directly to the surface of the iron will be impaired. Another objection is that the mill-scale, rust, etc., can be removed more cheaply and readily at the shop than in field. Allowing, for sake of argument, the validity of all these objections, the extra trouble of

eliminating in the field these detrimental features is of far less importance than the serious damage done to the structure by covering all the defects under the protecting mantle of an indiscriminately daubed-on coat of shop paint. Of course, shop painting is preferable where it can be carried out under efficient supervision or satisfactory guarantees of careful work.

The methods for removing grease, dirt, rust, mill-scale, etc., consist in rubbing with benzine, brushing with wire brushes, scraping with special tools and tapping with hammers. The sooner iron can be cleaned and protected after leaving the rolls, the better it will prove all around.

The "pickling" of iron in dilute acids (as done for certain classes of work, especially ship work) has been suggested for bridge work, but there are probably sufficient reasonable objections that can be raised against it to warrant its non-adoption.

The cleaning of the iron with power-driven revolving wire brushes, or by a sand blast after leaving the rolls, or early in the stage of manufacture in the bridge shop, is spoken of with more favor. Possibly the manufacturer who guarantees absolutely clean iron may some day secure an advantage over his less far-seeing rivals, and buyers of bridge iron may become educated to such a point as to pay a premium for such iron, owing to the subsequent saving in the maintenance expenses of the structure.

The prime importance of the proper preparation of the surface having been properly stated, the next most serious element bearing on the subject of bridge painting is the:

Influence of the Vehicle.—The best and only vehicle for oil paints is pure linseed oil. It has its faults, the main one being that it is porous and does not absolutely repel moisture; but the fact remains that the best authorities agree that it is to-day the only article that should be used. No amount of scientific and practical sophistries can change the fact that so-called substitutes for linseed oil have not thus far been able to replace the pure article for good work, and that their efficiency is probably gaged to a large extent by the proportion of linseed oil in the mixture.

There is a great deal of secrecy maintained about the vehicle in the manufacture of ready-mixed paints. Asphalt and coal tar have, no doubt, in themselves certain oils which serve partially as vehicles. But from the best information obtainable all paints of whatever nature, whether the pigment base is asphalt, coal-tar, graphite, carbon, metallic, mineral, etc., all require linseed oil or some siccative oil of a similar nature. In some secret processes the aim is claimed to be the improvement of the linseed oil by additional treatment, causing clarification and improved drying and water-resisting properties, while in others the entire process consists, no doubt, simply in working in sufficient "substitutes" to make the paint a "financial success."

To show the strong temptation to adulterate linseed oil (it is adulteration under whatever name it may be veiled), it will only be necessary to call attention to the fact that the cost of the vehicle in an ordinary oxide of iron paint, for instance, is about 8-9 of the entire cost of the paint.

Pure linseed oil sells for from 50 to 60 cts. per gallon. The present rate is 56 cts. for raw and 59 cts. for boiled oil. There are special refined kinds, used principally for the making of fine paints and varnishes, that cost even more. When, therefore, ready-mixed "all linseed oil" paints are sold for about the cost, or even less than the cost, of the linseed oil in the paint, the fraud is certainly apparent. Benzine, rosin, water, fish and mineral oils, etc., cannot take the place of linseed oil, never mind how attractive the inducements and testimonials are, and how alluring the trade-name of such stuff, which generally sells for from one-third to one-half the cost of pure linseed oil.

It is very important to call attention to the fact that there are scores of mixtures sold as "pure linseed oil" or as "good as linseed oil." The plea just quoted is actually made use of by manufacturers of substitutes, thereby bearing silent testimony to the superiority of linseed oil.

"Vehicle vs. Pigment" is one of the stubbornly contested questions in the oil paint business. Excluding statements from parties financially interested, numerous authorities can be found claiming that "the value of the paint for preservative purposes is mainly in the vehicle," while others state that "the pigment gives a paint its chief preservative qualities." There seems no doubt that, from the best information available, the oil is the weakest component of paint—i. e., will give out first, provided, of course, that the pigment base is pure and stable, properly prepared, and does not contain injurious elements in itself. This, therefore, emphasizes the necessity for the very best and purest oil.

There is one more point requiring attention—namely, the use of "raw" or "boiled" linseed oil. Boiled linseed oil is made by boiling the raw oil with an admixture of litharge, manganese or other drying compounds. Boiled oil dries more quickly than raw oil. It is popularly supposed to be better, as it costs more and has undergone an extra treatment. This treatment, however, is often an illusion, as certain chemicals are frequently simply added to the oil without any subsequent boiling, which has given rise to the name "bung-hole boiled oil." There is no question that there is a decided preference for raw oil shown in practice, and supported by eminent authorities, as raw oil can be obtained pure more easily than boiled oil, and, if the drying power of the raw oil is not satisfactory, it can be improved by adding drying mixtures of known compounds. There is no serious objection to japan as a drier and to turpentine as a solvent, provided the articles are pure and their use is limited just as much as possible.

As above stated, it is desirable to get some article for an oil paint vehicle that is superior to pure linseed oil. There are several compounds now on the market claiming to be better than linseed oil, in other words, not substitutes, which may, after longer and more conclusive tests, prove superior and supplant linseed oil. But for the present there is nothing absolutely shown to be better, and hence the endeavor should be to use only the best pure linseed oil.

Next in importance to the preparation of the iron surface and the choice of the vehicle is the

Selection of Pigment for Priming Coat.

In the endeavor to select a suitable pigment for the priming coat of iron bridges, we are brought face to face with the great paint controversies of the day, in which the friends and manufacturers of any particular class of paint invariably back their favorite against the field. To successfully untangle the chaotic mass of statements and counter-statements, good and bad results, carefully and loosely conducted tests, more or less carefully reported, and get at an absolutely reliable decision, is hardly within the power of one man. All that can be done is to arrive at a personal opinion and conclusion from the best available light on the subject.

The importance of the priming coat of iron is due to the fact that if there are any chemicals in the paint, causing deterioration of the iron, they are brought in direct contact with the iron to be protected, causing more rapid destruction. Another feature is that the perfect adhesion of the first coat to the iron surface is essential, as any number of subsequent coats cannot correct the defects of the first coat in this respect.

There is no doubt that the use of oxide of iron paints for a priming coat on iron or steel surfaces is being discarded by a great many of the prominent railway companies of the country, owing to its alleged action as a promoter of rust, when in direct contact with iron or steel. This mistrust may be largely due to chemical and scientific arguments, but has probably been created mainly by the abominable mixtures that have been and are sold as iron paints, in which not only the oil, but also the pigment is adulterated by the admixture of foreign substances. This is done not so much to decrease the cost of the pigment as to diminish its large oil-absorbing qualities, the saving in oil being the most telling all-around economic feature in the paint manufacturing business.

The answers from about 30 prominent railways in the country as to their prevailing practice show that over 80% of them are recommending and using as a standard, especially for new work, red lead and linseed oil for priming coats. On a number of roads it is used with a small percentage of lampblack or graphite, which seems to be preferable, as it makes the paint work better.

Another tendency of the day is to adopt so-called chemically and electrically inert pigments for priming coats, obviating all the serious chemical and galvanic electrical questions connected with metallic paints. The principle is no doubt correct, but in how far the patent asphalt, graphite, carbon, anti-rust and mineral paints are going to answer all the requirements made of first-class bridge paints is uncertain, as there are not sufficiently unanimous results and opinions in the matter to warrant a decision at the present time.

As above stated, iron oxide seems to be discarded for priming coats of ironwork, while red lead appears to be quite extensively used by railways, in spite of its principal practical objections—namely, rapid setting and liability to run on vertical surfaces. The use of red lead, toned down with lampblack, for priming iron is to be considered as good general practice to-day.

It is exceedingly important, however, to arrive at some definite results relative to the efficiency of genuine asphalt paints (not cheap coal-tar, benzine, fish and mineral oil mixtures), and of the best known brands of graphite and carbon paints. The following up of Dr. Charles B. Dudley's formula and recommendation to use a French ochre and lampblack mixture is also very desirable.

The conclusion reached, therefore, is that red lead toned down with lampblack is the best primer for iron, according to the prevailing practice of the day, but that it is very desirable to test extensively the most reliable brands of first-class asphalt, graphite and carbon paints, including Bessemer paint and Dr. Dudley's formula, as these paints seem to offer better chances for establishing a more permanent standard, owing to their construction apparently on more scientific principles than the metallic paints.

Selection of Pigment for Finishing Coat.

The selection of the pigment for finishing coat is influenced largely by the finishing color that is desired. If a light color is required, then white lead paint or a white lead and zinc mixture has to be used, with suitable coloring matter. Red lead can be used, preferably toned down with lampblack giving a chocolate brown or black. Iron oxide can be used alone, giving the well-known red-brown color, or it can be toned down with lampblack to a dark brown tint. A genuine asphalt, graphite or carbon paint is very dark gray or practically solid black.

Any shade similar to rust color should be avoided, as it prevents following up rust indications in maintaining a structure. Red is also objectionable on railways on account of its similarity to danger signals. Light colors fade very soon, and at any rate look dirty very quickly, owing to the surface accumulations of dust and smoke particles. In cities the light colors and the varying of the colors for different members of a bridge may be desirable from an aesthetic point of view, but the most preferable colors for bridges along the line of a railway, outside of special cases in large cities, are the dark shades from chocolate brown to black, and the best practice is to paint the entire bridge one color.

Following the general drift of the conclusions reached thus far, it will be apparent that the kind of paint selected for the finishing coat has not been considered as important as the features that the iron surface to be painted should be properly prepared, and that the priming coat or coats should be of the best kind of red lead and pure raw linseed oil, toned down with lampblack, or preferably (after satisfactory tests) of some first-class carbon, graphite, asphalt or similar paint.

This being the case, the natural conclusion is that any good grade of paint, with a pure linseed oil vehicle and a very finely ground, stable and chemically non-injurious pigment will answer for the finishing coat or coats of iron bridges.

For repainting old bridges similar principles hold good. The old paint where bad must be removed to the surface of the iron, but where it is still firm it will prove practically as good to paint on as the iron. Give the same rigid attention to preparing the surface to be painted as discussed above for new work, and then paint with any good grade of paint, as outlined above.

Best Method of Purchasing Supplies.—A railway company should, as far as possible, control the purchasing of the raw supplies and superintend the

mixing of the paint by its own men. If patent ready-mixed paints are used, of course this is not possible. Oxide of iron can be bought in powder or paste form. Red lead has to be bought in powder form. White lead and graphite paints can be bought in paste form or ready mixed. All other paints are sold mixed ready for use.

The advantage of buying in powder form consists in the better ability to examine and test the quality of the pigment; while the great advantage of buying in powder and also in paste form is that the chief article of adulteration—namely, the oil—can be bought separately, insuring an absolute guarantee as to the purity of the paint, if ordinary precautions are observed. In addition, the quality and amount of driers or solvents to be added is under the control of the railway company's painter.

In buying raw materials, such as oxide of iron, red lead, white lead, and graphite, it is desirable to purchase direct of the best established houses in the business. In the purchase of linseed oil the same remark holds good.

The fact that the material is only from one-sixth to one-half the entire cost of painting (according to the cost of the paint, the amount of scraping to be done, and the nature of the structure and the scaffolding required), illustrates forcibly that it is true economy to purchase good materials in the start, so as not to have the expense of frequent renewals, the labor of which will amount to from one to five times the cost of the materials. For ordinary bridge painting the cost of labor (exclusive of scraping) is about twice the cost of the paint itself.

In regard to the claim of manufacturers of mixed paints, that great research and experience are required to compound mixtures, it will not be out of place to remark that the ordinary run of metallic paints can be mixed by the railway company's men equally as well as by manufacturers, just the same as in the lubricating oil business. The alleged advantage of mixing by machinery can be obtained readily at a company's shop with a small hand or power mixer, in place of paying extra rates for unknown mixtures, claimed to have been mixed by machinery. In fact, a number of railways maintain mixers at their paint shops. To sum up, then, I will state that the tendency should always be to purchase, as far as possible, pure raw stock and do the mixing by hand or with a small mixer by company's men.

Best Method of Doing Work.—Contract painting should be abolished, except when the peculiar conditions of the case necessitate it, such as, for instance, the first coat at bridge shops. Even then, as pointed out above, it is preferable to specify a coating of linseed oil at shop, unless the painting can be properly superintended.

All work in the field, painting new bridges, or repainting old structures, should be done by the railway company's men, never by contract.

Recommendations.

The conclusions reached above are embodied in the following recommendations for painting iron and steel bridge work:

For New Work.—The MOST IMPORTANT FEATURE is to prepare the iron surface before painting by removing all dirt, grease, mill-scale, rust, etc., and not to paint when the iron is wet or the weather cold. The next important feature is to use strictly pure linseed oil, bought direct of some well-known house.

For the priming coat, use pure, finely ground, dry red lead, toned down with lampblack, and mixed with pure raw linseed oil, adding as little drier as possible. The painting to be done by the railway company's men under a rigid and constant inspection. Where this is not feasible, prescribe a preliminary coat of linseed oil to be applied before the iron leaves the bridge shop and proceed later with the priming coat, as specified above, removing first all surplus oil, and any grit, rust, dirt, etc., that may have collected on the iron in the transit from the bridge shop.

For finishing coat or coats use any kind of suitable paint, preferably dark colored, provided the quality of the pigment is not injurious and the linseed oil is pure. The painting to be invariably done by the railway company's men under a rigid and constant inspection.

If economy in first cost is essential, necessitating the choice of a cheap paint for finishing coats, use oxide of iron paint, bought in powder form, and toned down with lampblack, in preference to all ready-mixed cheap grades of patent paints on the market.

As far as possible, buy pure raw materials, dealing direct with the best and most reliable houses, and have the railway company's men mix all paints either by hand or with a small hand or power mixer set up at the paint shop.

For Repainting Old Work in Bad Condition.—Remove all dirt, grease, rust, and old scaling or soft paint, and use red lead primer, followed by a finishing coat or coats of any kind of suitable pure paint, the same as prescribed above for priming and finishing coats on new work.

For Repainting Old Work in Fair Condition.—Remove all dirt, grease, rust and old scaling or soft paint, touch up all bare spots with a preliminary extra coat of paint, and complete with one finishing coat of any kind of suitable pure paint, the same as prescribed above for finishing coats on new work.

Desirable Paints for Testing.—It is very desirable to obtain promptly some full-size comparative tests —i. e., paint test bridges with the following paints, which seem to offer sufficient good features to warrant these tests being made, so as to establish whether these paints will give better results than red lead or iron oxide paints, especially for priming iron:

Dr. Dudley's Paint Formula: 39 lbs. French ochre, 1 lb. lampblack, 54 lbs. raw linseed oil, and 6 lbs. japan.

Black Bridge paint, of Edward Smith & Co., 45 Broadway, New York city.

Bessemer paint, of Messrs. Rinald Bros., Philadelphia, Pa.

Graphite silica paint of Joseph Dixon Crucible Co., Jersey City, N. J.

Carbon primer of Sherwin-Williams Co., Cleveland, O., and 178 Fulton St., New York city.

Graphite paint of Detroit Graphite Manufacturing Co., Detroit, Mich.

A NEW AIR COMPRESSOR.

The ideas which have controlled the design of the novel and very interesting air compressor which is shown in the accompanying illustration will probably be evident to those of our readers who are familiar with the principles of air compression. A difficulty which has to be met in the design of all steam-driven air compressors is that the steam piston does the bulk of its work during the first half of its stroke, while the air piston does the bulk of its work during the last half of its stroke. On this account all compressors of large size are built duplex, the two sides being connected to a common flywheel, with the crank at an angle of 90° with each other. By this means the steam cylinder of one side during the first half of its stroke gives its surplus of energy to the other side, where the steam is being expanded and the air cylinder is absorbing the maximum power.

But for small size machines the duplex type of compressor is too costly and complicated, and the practice is therefore to equip the machine with a very heavy flywheel, which absorbs power during the first half of the stroke, and gives it up during the latter half.

In the compressor, of which a side elevation is shown in Fig. 1, the designer has aimed to improve the working of an air compressor with a single steam piston, by connecting it with the piston of the air cylinder not directly but by a system of linkwork, which gives the steam piston "the short end of the lever" during the first part of the stroke, and the long end during the last part.

Fig. 2 illustrates the action of this linkwork. The full lines show it in the position at one end of the stroke; the dotted lines, its position at the opposite ends. Also the motion of the steam piston is divided into five equal parts, and the corresponding positions of the linkwork centers and of the air piston are plotted for each point. It will be seen that while the steam piston makes the first fifth of its stroke, the air piston makes two-fifths of its stroke. At the opposite end, when the air piston is completing its stroke, the condition is reversed, and the air piston moves only one-third as rapidly as the steam cylinder.

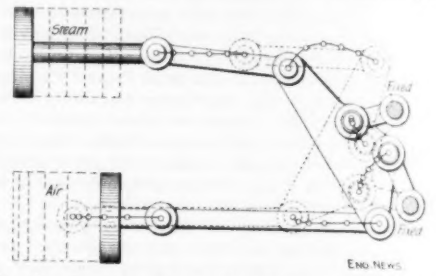


Fig 2. Diagram Illustrating Action of Link Work in New York Air Compressor.

In the diagram in Fig. 2 the two pistons are taken as of the same size and stroke for the sake of simplicity. In practice, of course, the diameters of steam and air cylinders may be varied according to the relative pressures of air and steam and other controlling features. Fig. 3 shows in full lines indicator cards from a compressor of this class working in the shops of the builders. The steam cylinder was 9 × 10 ins., and air cylinder 10½ × 10 ins. Ordinates have been drawn on the steam card dividing it into ten equal parts, and ordinates on the air card show the positions of the air piston corresponding to the positions of the steam piston given by the ordinates on the steam card. The decimals below the air card show the fractional part of the stroke which the air piston makes for each one-tenth stroke movement of the steam piston. It will be seen that at one end of the stroke the air piston moves only one-eighth as far for a given movement of the steam piston as at the opposite end. The dotted line on the steam card shows the steam pressure line corrected for the effect of reciprocating parts, and thus represents the useful work delivered to the cross-head pin by the steam engine.

This dotted line was then transferred to the air card in inverse proportion to the relative speeds of

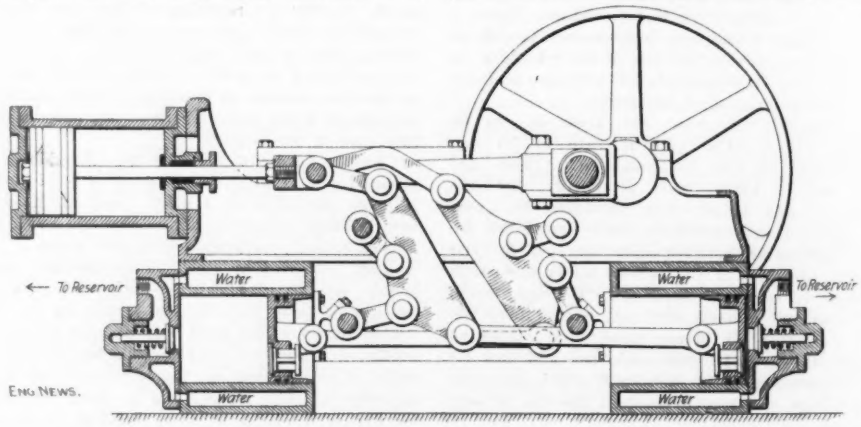


FIG. 1. LONGITUDINAL SECTION OF THE NEW YORK AIR COMPRESSOR.

the two pistons and their respective areas. In this transfer no allowance has been made for friction or the effect of the flywheel. Part of the surplus power in the early part of the stroke is required for friction in the engine and compressor, and in imparting velocity to the moving parts.

It will be apparent that with the design above explained, a much lighter flywheel is sufficient to give a steady motion to the machine and a more uniform rotation is obtained.

Referring again to the general elevation of the machine, Fig. 1, it will be seen that there are two single-acting air cylinders. Each air cylinder is cooled by a water-jacket around its barrel and head, and the piston is also cooled by having one face exposed to free air. Besides this advantage of the single-acting type, the air cylinders are accessible for inspection, repairs or renewal of packing without removing any cylinder heads, lubrication is more readily secured, and the bore of the cylinder is not only cooled by the water-jacket, but is exposed to air at atmospheric temperature during half its stroke. It will also be noted that the speed of the piston is slow during the latter part of the stroke, when the temperature is high, giving more time for the heat of compression to be absorbed by the cooling surfaces.

Among other interesting features of the design it

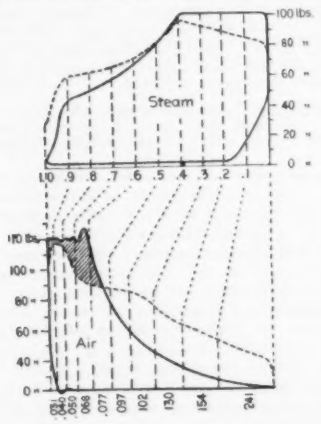


Fig. 3. Indicator Diagrams from Steam and Air Cylinders, New York Air Compressor.

may be pointed out that no stuffing-box is required with the single-acting cylinders, and air leakage from that source is saved; clearance can be almost eliminated, as the last quarter-inch of travel of the steam piston moves the air piston only 1-16 in.; the air cylinders form the foundation of the machine, therefore no more floor space is required than for a steam engine of the same size cylinder.

The inlet valves, located in the air pistons, are simple poppet valves without springs, opened and closed by their own inertia. The outlet valve is opened by air pressure against a very light spring.

The makers claim that the machine can be run with a very short cut-off in the steam cylinder on account of the adjustment of effort by the linkwork, which we have already described. We should apprehend also that the machine could be run at a much lower speed than ordinary air compressors. The small area of the shaded portion of the air card in Fig. 3 is evidence of this. If this is found to be the case in practice, it should materially improve the economy of the plant in regular service, as the machine would meet varying demands by varying its speed, instead of by alternate stopping and starting, or by turning over without doing work, as is customary with air compressors in general use.

The capacity of the machine, we understand, has been shown by tests to be about 300 cu. ft. of free air compressed to 100 lbs. pressure per indicated horse-power in the steam cylinder. The machine, with 9 × 10-in. steam cylinders, weighs about 4,000 lbs. The same machine, built without the steam end, to be driven by a belt to a pulley on the flywheel shaft, will weigh about 3,000 lbs.

The machine is built and put upon the market by the New York Air-Brake Co., of 66 Broadway, New York city, and Watertown, N. Y. It was designed by Mr. Albert R. Massey, the company's Mechanical Engineer.

An apparatus for simultaneously closing all the bulkhead doors of a warship is said to have been devised by Commodore Melville, Engineer in Chief of the Navy, the apparatus being operated by electricity or compressed air, by means of a lever in the wheel house or conning tower.

The route from London to China and Japan, via the Trans-Siberian railway, is recommended by the "Gazette de St. Petersburgh" as shorter than any other route—when that line is completed. As that journal figures it out, the journey from London to Moscow will consume 2½ days; a through train from Moscow to Vladivostock, traveling at the rate of about 22 miles per hour, would cover the distance in 11 days more; and, allowing 600 nautical miles for the distance between Vladivostock and Nagasaki, or 1,000 miles to Chinese ports, the London traveler should reach Japan in 16 days and China in 17 days. Going west, across the Atlantic, Canada and the Pacific by the shortest route, the distance is 12,800 nautical miles, and the time from London is 28 days to Japan and 30 days to China. The "Gazette" expects an enormous future traffic for this railway and the building up of a powerful Russian fleet as a consequence.

The sixth International Geographical Congress will be held at the Imperial Institute, London, from July 26 to Aug. 3, next inclusive. An exhibition in connection with the Congress will be held at the Imperial Institute, from July 20 to Sept. 1. The Paris, Berlin and St. Petersburg geographical societies have undertaken to organize the exhibits of their respective countries, and it is expected that the exhibition will be the best ever held.

The direct-heat tunnel system for drying cement, which is a specialty of the F. D. Cummer & Son. Co., of Cleveland, O., has in one case replaced a steam-drying system, and is said to be doing the same amount of work with half the fuel, and to be drying twice as much material in a given space. By the steam system, the air was delivered to the tunnels at about 160° to 180° F. By the direct-heat system, the air may be delivered at a temperature of 500°, and may be discharged at the wet end of the tunnel at any desired temperature, about 80° being considered the proper temperature if a proper volume of air has been mingled with the products of combustion. A wet cement mixture containing 40% of moisture can be dried in less than 24 hours. Hard coal or soft slack coal can be used for fuel, mechanical stokers being used for the latter.

A power dam across the Mississippi River at Minneapolis is being started under the direction of Mr. Charles A. Pillsbury, with Mr. William de la Barre, M. Am. Soc. C. E., engineer of the two water power companies, as Engineer-in-Charge. The estimated cost is $700,000, and the power generated will be sold to all comers, and possibly used in connection with the trolley lines of the city.

In connection with the depression of the tracks of the Reading Railway, on Pennsylvania Ave., in Philadelphia, a system of low-level sewers is being constructed. The entire length of the railway improvement is about two miles, and provision is being made for four tracks laid not less than 25 ft. below the street surface. To drain this subway, new sewers are required, and these are being built in tunnels driven from shafts located about 250 ft. apart and varying in depth from 40 to 50 ft. The estimated cost of this track depression is $6,000,000; and the new sewers alone will cost about $500,000. The sewers are now practically completed.

The estimates for buildings in course of construction in New York in the first quarter of the year are given as follows by the N. Y. Bureau of Statistics of Labor, in contrast with previous years:

New York city.	1893.	1894.	1895.
Number of plans filed	655	538	1,107
Es'm'd cost of above.	$14,879,638	$9,418,939	$27,462,514
Es'm'd cost of alter's.	$1,992,594	$1,060,940	$3,687,456
No. proposed alter's..	578	474	579

Similar statistics for Buffalo, N. Y., show 326 plans filed for new buildings and alterations for the first quarter of 1895, aggregating in cost $3,416,821.

The Lake Superior Power Co. has made a proposition to the city of Sault Ste. Marie, Mich., to take hold of the water power project if it can obtain right of way for the canal at reasonable rates.

Good road construction in New Jersey is making rapid progress. Morris county is now about to construct nearly 50 miles of macadam and telford roadway, for which contracts will be let June 19. The graded width of the roads is from 20 to 30 ft., with stone paving 12 to 14 ft. wide. The depth of the road metal used varies, according to the traffic, from 4 ins. of macadam laid directly on the soil to the same amount laid on 5 to 6 ins. of telford foundation. The work will be done under the direction of Mr. William E. King, County Engineer, Landing, N. J. Mr. Merrett B. Lum, Chatham, N. J., is Director of the Board of Freeholders.

ANNUAL CONVENTION OF THE AMERICAN WATER-WORKS ASSOCIATION.

The fifteenth annual convention of the American Water-Works Association was held at Atlanta May 28, 29 and 30. The attendance was fair, the social delights of the occasion were above the average, and a number of good papers, prepared with great care, were presented. The discussions on some of the papers was practically lacking and on others very meager.

But while the public discussions were, in some respects, unsatisfactory, the private interchanges of opinion on various phases of water-works construction and management were of great value. Indeed, some of those present said emphatically that this feature was by far the most important one of any such convention.

The proceedings at the opening session consisted chiefly of addresses of welcome, and were given in our last issue.

Tuesday Afternoon.

The first paper of the afternoon and the second of the convention was by Mr. Isaac B. Potts, of Columbus, O. Its title was "The Future Water Supply for Inland Cities and Towns," and it was read by the secretary. The author referred to the decrease in available water supplies for domestic, irrigating and manufacturing purposes caused by various changes, and suggested that reservoirs be built for the storage of water. A cheaply constructed reservoir one acre in area was advocated for each 100 acres of land, the water to be 4 ft. deep. The only discussion bearing upon the paper was by Mr. J. M. Diven, who thought that such shallow reservoirs would be mere mudholes.

Mr. P. H. Lineen here raised the point brought up by him at the morning session: That a paper presented to the convention only by a hurried reading could not be expected to elicit discussion. He urged that either the papers be printed and sent to the members in advance or that discussion on all the papers presented at one meeting be postponed until the next. Meanwhile the papers would reach the members in printed form in the annual report. Mr. Diven said that the papers for the Philadelphia convention, in 1801, were printed, but that the plan had not been followed since. The president and secretary stated that the papers were not received soon enough for printing. Mr. Lineen thought that after 15 years of existence it was time for the association to put itself on a par with others in this matter. It was finally decided that the papers presented at any meeting should be open for discussion at subsequent meetings.

The secretary then read a paper by Mr. John Newhall, Superintendent of the Crystal Water Co., Edgewater, N. Y., on "Practical Experience with a Meter System." An abstract of this paper was given in our last issue. Discussion was postponed until after the other papers on meters should be read.

The session closed by the reading in outline of a proposed paper by Mr. J. M. Goodell, Assoc. Am. Soc. C. E., on the "Use of Electric Pumping Machinery for Water-Works." In the absence of the author, this was presented by Mr. L. H. Gardner. At the special request of Mr. Goodell, we refrain from publishing the above abstract, further than to say that it sketched the development of gas pumping engines in Germany and described briefly electrical pumping plants in this country at Monroe, La.; San Antonio, Tex.; De Kalb, Ill., and Canandaigua, N. Y., the latter being under construction. Full descriptions of these plants, with illustrations, are promised by Mr. Goodell later.

Mr. P. H. Lineen thought gear transmission, mentioned in the above paper as in use at some places, out of date. He had been taught that the closer the application of power could be to the load the better. The development of steam at one point, the sending of energy in the form of electricity to another and the final transmission of the power through gearing he thought were hardly worth the consideration of the association.

Wednesday.

At the opening of the session the secretary read his report. The total membership of the association is now about 385, of which some 75 are associate and one an honorary member. The net gain in membership during the year was about 15.

The first paper of the day was entitled "Our Experience with Meters," by Mr. John B. Heim, Superintendent of the water-works of Madison, Wis. The author outlined the steps that led up to the adoption of meters: A limited artesian supply, rapid increase

in waste and reduced pressure. The city began to place meters in May, 1888, and on Sept. 30, 1894, had 759 out of 1,820 taps metered. The city owns the meters, and has placed them on consumers in order of the amount of their rental at fixture rates, from highest to lowest. Eventually all consumers will be metered. The minimum meter rate is $5 a year, water being furnished at from 5 to 20 cts. per 100 cu. ft., or 6⅔ to 26⅔ cts. per 1,000 gallons. The water consumption in 1884-85, before meters were introduced, was 740, and in 1893-4, 409 gallons per tap. The taps increased about 125%, and the total yearly pumpage about 35% during the period.

Before a meter is set it is tested with from 1-32 to ½-in. jets, and a 2% error either way throws out the meter.

The meter system has brought with it an improvement in plumbing, and has postponed the enlargement of the works, which ten years ago was apparently an immediate necessity.

Discussion on this paper having been postponed, the secretary read one by Mr. L. N. Case, General Superintendent of the Detroit Water-Works, on "Water-Works and Their Management." Mr. Case set 60 gallons per capita as a liberal water supply, and favored meters with a flat scale of rates. The water commissioners of Detroit have recently secured legislation which enables them to assess abutting property for water main extensions, provided no lot is assessed for more than its proportional share of a 6-in. main. The author stated that while it may be impossible to establish a uniform basis of rates, owing to varying conditions for different works, he was satisfied that much greater uniformity than now prevails might be obtained.

In the discussion which followed, this point seemed to have been misunderstood, as a number of members spoke emphatically of the impossibility of absolutely uniform rates throughout the country.

Mr. Case's advocacy of flat meter rates was quite strongly opposed; Mr. F. A. W. Davis, of Indianapolis, Mr. J. M. Diven, of Elmira, Mr. P. H. Lineen, of Chicago, all interested in private water companies, speaking strongly against it. Mr. Geo. H. Benzenberg, M. Am. Soc. C. E., City Engineer, of Milwaukee, said that a minimum meter charge was unjust if a sliding meter scale could be so characterized. You may have one meter passing 1,000,000 gallons in a given time and 1,000 others passing no more in that period. The same rule is not applicable to each.

Mr. Denman called attention to the fact that the absence of the writer of a paper frequently leads to injustice being done the ideas which he presents in the discussion. Doubt as to what the writer really means is quite likely to arise if he is not present to answer questions.

Mr. Milne believed in flat meter rates. They have been adopted in Brooklyn, although one-fifth of the entire revenue of $1,300,000 a year comes from a few large meters. The rate is 10 cts. per 1,000 gallons, or about the actual cost to the department.

The frontage assessment plan was discussed at some length. This is applicable only to municipally owned plants. St. Paul, Mr. John Caulfield stated, charges 10 cts. per front foot for ten years to defray the cost of the mains. Rochester charges 3 cts., but for how long Mr. Neville did not state. In Milwaukee, Mr. Benzenberg said, property is charged the actual cost of a 6-in. main, which is now 85 cts. per lin. ft., or about 43 cts. per front foot. The principle involved is that the mains are a benefit to property, even if there are no buildings upon it. A tilt here arose between Mr. Benzenberg and Mr. Lineen, the latter claiming that the principle was wrong, but receiving little or no support from the convention. It was stated by several that the frontage tax was a necessity, to prevent a constant demand for extensions into unsettled territory to boom real estate, and the attempt to secure such extensions through political influence.

Mr. J. H. Harlow, M. Am. Soc. C. E., said that water rates are established in a very haphazard way, with but little regard for the cost of building or running the works. The frontage plan is fair, and meters are the only honest way of charging for water.

Mr. C. Monjean submitted a brief report from the committee to memorialize Congress on stream pollution. The proposed memorial was printed in the last annual report of the association. The committee was continued and expects to present its memorial in due time, asking for national legislation on this subject.

Mr. O. J. Loder, of Peekskill, N. Y., presented the names of Messrs. H. G. Holden, L. H. Gardner, J. M. Diven, P. H. Lineen and C. N. Priddy as a committee to nominate officers for the ensuing year. Mr. Lineen offered as a substitute Messrs. Chas. E. Bolling, O. J. Loder, W. H. Laing, A. N. Denman and John Caulfield. Mr. Lineen then said that the convention has no voice in choosing officers. He would be glad to see two tickets. After much discussion, the first ticket was withdrawn by Mr. Loder, and the second one approved by the convention.

Thursday Morning.

The first paper was by Mr. Rome G. Brown, a lawyer, of Minneapolis. It was on "The Right to Take Water from Streams and Lakes for Public Water Supplies." The author set forth the fundamental principles of this subject, citing numerous court decisions and authorities. Mr. Brown spoke from notes instead of reading his paper, which covered some 35 typewritten pages, and will, of course, be printed in the minutes of the meeting.

The third paper on meters to be presented at the convention was by Mr. Fred Crosby, Superintendent of the Capital City Water Co., Montgomery, Ala. The title of the paper was "Some of the Difficulties and Advantages that Have Arisen by the Use of Meters in a Southern City." The difficulties were chiefly caused by ambiguity in the franchise, and hinged largely on whether consumer or company should pay for the meter. The advantages have been the usual ones of cutting down or keeping down consumption, and an equalization of rates, the meters showing great inequality in the price per 1,000 gallons paid under fixture rates. The paper closed with a long table showing the consumption per meter before and after repairing leaky fixtures, the reduction in many cases being very great.

The conclusion of this paper was the signal for beginning the discussion of the meter question, which had been postponed until this time. Mr. French, of Hoboken, believed in testing meters before setting them, but when large numbers are put in at one time this may cause too much delay. Passing 10 cu. ft. of water through the meter does very well. These points were made in reference to the paper by Mr. Newhall, abstracted in our last issue. In this paper testing all small meters once in two years was advocated. Mr. French said he had some meters which had run eight or nine years without testing. Recently he began to test all small meters when they had passed 100,000 ft., and larger ones after having passed double that quantity. Some surprising results had developed, but not knowing the contents of these papers on meters before leaving home he had not come prepared to give figures.

A number of members spoke about either the testing of meters or on who should own the meter. The general consensus of opinion was that meters should be tested before setting. The recent trend of thought in regard to ownership of meters seems to be in favor of making them a part of the water-works plant, instead of the property of individuals, but some companies take the opposite stand very strongly. Someone urged that where the consumer wanted the meter he might properly pay for it.

Mr. Dabney H. Maury, Jr., Superintendent of the Peoria Water Co., stated that he had 1,000 meters in use. He has a riser from the service near his meter from which either consumer or company may draw water to test a meter at any time. He believed in meters, but they cost a good deal of money for buying, setting and repairs. A meter in place will cost from $20 to $30, and reading, repairs, interest and depreciation cost in Peoria some $7 per meter per year.

Mr. John C. Chase, Superintendent of the Clarendon Water Co., Wilmington, N. C., said they charged $2.50 for setting and boxing each meter, but nothing more and no rental.

Mr. French then stated that there are 12,000 meters on the works in and near Hoboken, N. J. Safety valves are placed on each hot water boiler, the check-valve at the meter preventing the backward flow of the water in case of the formation of steam in the boiler.

Mr. Mather, of Harrisburg, said the city owned 2,200 meters, of which about 50 were on manufacturers, these latter only being owned by the city. Before the adoption of meters the lump sum plan was in vogue for manufacturers, and it was found that one man was getting water at ½ ct. per 1,000 gallons. Mr. Milne spoke of the mechanical conditions necessary to good results in the setting of meters.

The last paper on the programme for the morning was by Mr. Chas. Hague, M. Am. Soc. M. E. This paper, entitled "The Possibilities of Electrical Pumping Machinery," was presented in abstract in our last issue.

Thursday Afternoon.

The closing session was almost wholly devoted to routine business. On motion of Mr. Davis, of Indianapolis, the president was authorized to appoint a committee to report on legal matters affecting water-works interests. It was voted to incorporate in the proceedings of the convention an article from Appleton's Encyclopedia for 1894 on "Cast Iron Pipe and Its Characteristics," also volunteer papers on "The Appropriation of Private Water-Works Systems by Municipalities in the Dominion of Canada," by Willis Chipman, M. Am. Soc. C. E., and one relating to an attempt to increase the flow from the artesian wells of Fort Worth, Tex., by means of compressed air, by Mr. John B. Hawley. An abstract of Mr. Hawley's paper is as follows:

A portion of the water supply of Fort Worth is taken from 13 artesian wells, each cased to an internal diameter of 8 ins., and each about 1,000 ft. deep. The wells are located on a strip of land about 1,500 ft. in width and 1,000 ft. long, no two being nearer together than 800 ft. Water from the wells flows to the pump well through 8-in. connections to a collecting main from 12 to 36 ins. in diameter.

When completed in November, 1892, the aggregate flow of the wells was about 3,000,000 gallons per day, measured at the pump well. By November, 1893, one year after completion, the flow had decreased to 1,000,000 gallons, at which point it has remained until May, 1895. The removal of accumulated sand from the wells during 1894, by means of a portable well-drilling apparatus, did not materially augment the supply.

In June, 1894, Mr. Hawley found the city under a contract to purchase "air lift" apparatus for each of the wells, provided a test of the apparatus from two wells showed the "flow to be increased 2½ times." He placed weirs on the 13 wells, and found their total natural flow to be 1,060,000 gallons in 24 hours. The flow of No. 1 was 67,000, and of No. 2 57,000 gallons. These were the wells selected for testing.

The testing apparatus employed consisted of an air compressor (high pressure steam end), two lines of 3-in. wrought iron pipes to the wells, and about 400 ft. of 4-in. pipe suspended in each well, capped at the top, and having 1¼-in. pipe at its center. The small pipe terminated below in a 3-in. inverted bell. The air pressure maintained at each well was 66 lbs.

Both wells were tested together continuously for nearly ten days. Under the test each well delivered about 250,000 gallons per day, which was more than the contract requirement; but after the first ten hours the remaining 11 wells began to weaken, until at the end of the test they were yielding only 606,000 gallons. This made a total yield from all the wells of 1,106,000 gallons, or only 46,000 gallons more than the normal flow from them. The wells nearest those under test were most affected, three of them ceasing to flow.

A compromise was made with the "air lift" contractors by which the city was released from its contract on paying one-half the actual expense of the test.

The president was empowered to appoint a committee to devise ways and means to enable the "Committee on Vegetable and Animal Growths Affecting Water Supplies" to pursue its work.

Notice was given of proposed amendments to Article V., Section 3, of the constitution, relating to the manner of appointing the nominating committee.

Mr. Benzenberg, Chairman of the "Committee on Electrolysis as Affecting Water Mains and Sewer Pipes," reported that nothing had transpired during the past 12 months which would warrant the committee in changing the report submitted at the last meeting. The committee was continued for another year.

When the "question-box" was reached on the program two sets of questions were asked. Owing to lack of time, discussion of these was deferred until the first day of the next meeting, with the exception that a member stated in answer to one question as to the amount of water used by blast furnaces that 3,000 to 3,500 gallons of water are required per ton of pig iron manufactured.

Indianapolis was unanimously chosen as the place for holding the next meeting. Officers for the ensuing year, as recommended by the nominating committee, were elected as follows: President, W. G. Richards, Atlanta, Ga.; Vice-Presidents, F. W. A. Davis, Indianapolis, Ind.; John Caulfield, St. Paul, Minn.; Joseph A. Bond, Wilmington, Del.; Fred. Crosby, Montgomery, Ala.; Charles P. Allen, Denver, Colo.; Secretary and Treasurer, Peter Milne, New York city; Finance Committee, Dow R. Gwinn, Quincy, Ill.; C. A. Jones, Kansas City, Mo.; G. H. Benzenberg, Milwaukee, Wis.

During the meeting many courtesies were shown to the convention by the citizens of Atlanta. Excursions were made to the water-works pumping stations, filtering plant and reservoir, the garbage crematory and the Exposition grounds. An informal reception was held on Tuesday evening at the Kimball House. At the pumping station on Wednesday afternoon the members were treated to an old-fashioned Georgia barbecue. The construction of buildings for the Exposition was found to be well under way, and also the preparation of the grounds, all of which bid fair to be very pleasing.

Those in attendance at the convention were especially grateful to the Atlanta Water Board and Mr. R. M. Clayton, City Engineer, and to Messrs. W. T. B. and W. T. Wilson, assistants to Mr. Clayton, for the hospitalities which were so much enjoyed. The only event to mar the pleasure of the meeting was the fact that Mr. W. G. Richards, Superintendent of the Atlanta Water-Works, who after years of effort had succeeded in getting the association to come to Atlanta, was too ill to attend any of the sessions, or to be seen by those who called at his house.

A list of the exhibits of water-works appliances is given in the Construction News Supplement to this week's issue.

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PERSONALS.

Mr. N. S. Caswell is the new Superintendent of Water-Works at Parkersburg, W. Va.

Mr. Leander Williams, formerly Street Commissioner of Orange, N. J., died in that town May 29.

Mr. George A. Bullock, Chief of the Bureau of Highways, Philadelphia, Pa., has tendered his resignation.

Mr. Henry L. Budd has been appointed State Highway Commissioner of New Jersey. His residence is at Mount Holly, N. J.

Messrs. Frank J. Philbrick, Dr. Arthur E. Heffenger and Harry B. Yeaton have been elected Water Commissioners of Portsmouth, N. H., for one year.

Mr. H. M. Littell, General Manager of the New Orleans Traction Co., has been elected President of the Atlantic Ave. R. R. Co., of Brooklyn, N. Y. He is a well-known street railway man.

Mr. B. H. Bryant has been appointed General Superintendent, and Mr. A. L. Humphrey Superintendent of Motive Power, of the Colorado Midland Ry. Mr. George W. Ristone is Receiver and General Manager.

Mr. James Maglenn has been appointed Master Mechanic of the Seaboard Air Line shops at Raleigh, N. C., vice Mr. G. W. Eaves, resigned. He had held this position for some years previous to the appointment of Mr. Eaves last year.

Mr. Schieren, Mayor of Brooklyn, N. Y., has appointed Andrew D. Baird, James A. Sperry and Henry Batterman to act with him as the Brooklyn representatives of the commission for the construction of the new East River bridge.

Mr. Robert I. Sloan, M. Am. Soc. C. E., has been elected Water Commissioner of Asbury Park, N. J. He was formerly Chief Engineer of the Manhattan Elevated R. R., of New York, and the South Side Elevated R. R., of Chicago.

Mr. Joshua Briggs, M. Am. Soc. C. E., of Fordham, N. Y., has been appointed Chief Engineer of the Department of Street Improvement of New York city north of the Harlem River, succeeding Mr. Louis Risse, who has resigned to supervise the laying out of the new speedway.

The American official representatives at the International Railway Congress in London this month will include, in addition to the list given last week, H. Walter Webb, Third Vice-President of the New York Central R. R., and George Coppell, Chairman, and Edward T. Jeffery, President of the Denver & Rio Grande R. R. Co.

Mr. C. F. B. Haskell, M. Am. Soc. C. E., was drowned in the Columbia River, Washington, on May 21, while making surveys for government work. Mr. Haskell graduated from the engineering course of the University of Vermont in 1880, and had been engaged on railway location and construction on the principal railways of the Northwest during the past 15 years.

Mr. A. M. Underhill, Assistant Engineer of Maintenance of Way on the Chicago Division of the Pennsylvania R. R., has been appointed Chief Engineer of the Peoria Division of the St. Louis, Vandalia & Terre Haute R. R., with headquarters at Terre Haute, Ind., vice Mr. J. E. Starbuck, who has been transferred to the engineering department of the main line.

Mr. Charles Henry Parks, President of the Great Eastern Ry. Co., of England, died recently at the age of 79. He had held the position since 1874, and was one of the most progressive and far-seeing of English railway men, the result of his administration having been to raise this line from a bankrupt position to that of one of the richest and largest systems in England. This line is noted especially for its enormous London suburban traffic, built up by a policy of cheap rates and ample accommodation.

Mr. Samuel Schoch, who died recently at Newark, N. J., was born in Harrisburg, Pa., in 1835, and while a young man entered the treasurer's office of the Morris & Essex R. R. He became superintendent of the road, continuing in office until it was absorbed by the Delaware, Lackawanna & Western R. R., when he went to Texas, but left there to become General Manager of the Marquette, Houghton & Ontonagan R. R. He held that office until his health failed a few years ago, when he went to Newark and organized the Rapid Transit Street Car Co., of which he was made superintendent. He retired when the line was bought by the syndicate. At the time of his death he was president of the Positive Lock Washer Co.

Mr. James G. Dagron, M. Am. Soc. C. E., died suddenly at Philadelphia, Pa., on May 25, from a complication of heart and kidney troubles. Mr. Dagron was born at Fordham, N. Y., June 11, 1860, and was engaged in engineering practice, principally bridge work, since 1881, in which year he graduated from the "Ecole Central des Arts et Metiers," of Paris. His first work was with the Cincinnati Southern Ry., as assistant engineer in charge of bridge inspection. He left this railway in 1884 to take a position as Chief Inspector of Bridges on the Baltimore & Ohio R. R. In 1887 Mr. Dagron entered the structural department of the Pencoyd Iron Works as Manager, but returned to the Baltimore & Ohio R. R. in 1889 as Engineer of Bridges, which position he held until the spring of 1894. After that time he was engaged in various engineering works, holding the positions of Assistant Engineer of the topographic survey of the city of Baltimore, Md., and more recently Bridge Engineer for the Fairmount Park Electric Ry., of Philadelphia, Pa. He was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the American Institute of Mining Engineers, and contributed several papers to the proceedings of those societies. He leaves a widow, but no children.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

MONTANA SOCIETY OF CIVIL ENGINEERS.
June 8. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
INDIANAPOLIS ENGINEERING CLUB.
June 8. Secy., C. C. Brown, City Engineer.
ENGINEERS' CLUB OF KANSAS CITY.
June 10. Secy., F. W. Tuttle, Baird Building.
MASTER CAR BUILDERS' ASSOCIATION
June 11. Annual Convention at Alexandria Bay, N. Y. Secy., J. W. Cloud, Rookery Building, Chicago, Ill.
NORTHWESTERN SOCIETY OF ENGINEERS.
June 11. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
June 11. Secy., F. A. Coburn, Case Library Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
June 11. Secy., H. Breen, 36 Jacobson Block.
WISCONSIN POLYTECHNIC SOCIETY.
June 11. Secy., W. K. Means, Loan & Trust Building, Milwaukee.
NEW ENGLAND WATER-WORKS ASSOCIATION.
June 12. Young's Hotel, Boston, Mass. Secy., John C. Whitney, West Newton, Mass.
ASSOCIATION OF RAILWAY TELEGRAPH SUPTS.
June 12. Montreal, Que. Secy., P. W. Drew, Wisconsin Central Ry., Milwaukee, Wis.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
June 13. Secy., Jas. K. Zollinger, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
June 13. Secy., H. D. Ruhm, Nashville, Tenn.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
June 14. Secy., D. W. Meeker, St. Paul, Minn.
ENGINEERS' CLUB OF PHILADELPHIA.
June 15. Secy., L. F. Rondinella, 1122 Girard St.
AMERICAN RAILWAY MASTER MECHANICS' ASSOC'N.
June 17. Annual Convention at Alexandria Bay, N. Y. Secy., Angus Sinclair, 256 Broadway, New York city.
ENGINEERS' CLUB OF MINNEAPOLIS.
June 17. Secy., E. Nexson, Kasota Block.
COLUMBIAN ENGINEERING SOCIETY.
June 18. Secy., W. F. Hart, University Building, 15th and H Sts. N. W., Washington, D. C.
NATIONAL ASSOCIATION OF CAR SERVICE MANAGERS.
June 18. At Cleveland, O. Secy., A. G. Thomason, Scranton, Pa.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 18. Annual meeting at Nantasket, Mass. Secy., C. W. Hunt, 127 E. 23d St., N. Y. city.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
June 19. Secy., F. Van Vleck, Los Angeles, Cal.
WESTERN SOCIETY OF ENGINEERS.
June 19. Secy., Chas. J. Roney, 1736 Monadnock Block, Chicago.
BOSTON SOCIETY OF CIVIL ENGINEERS.
June 19. Secy., S. E. Tinkham, City Hall, Rooms 36 Bromfield St.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
June 20. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
June 20. Secy., J. F. Wilson, Odd Fellows' Temple.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
June 25 to 28. Annual Convention at Detroit, Mich., F. R. Hutton, Secy., 12 W. 31st St., New York city.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 25 to 28. At Niagara Falls, N. Y. Secy., R. W. Pope, 26 Cortlandt St., N. Y.
INTERNATIONAL RAILWAY CONGRESS.
June 26 to July 10. At London, England. Secy., F. Weissenbruch, Brussels, Belgium. Secy. of English Branch, W. M. Acworth, London, England.
AMER. ASS'N FOR THE ADVANCEMENT OF SCIENCE.
Aug. 28 to Sept. 7. At Springfield, Mass. Secy., F. W. Putnam, Salem, Mass. Local Secy., Wm. A. Webster, Springfield, Mass.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—The annual convention will be held at the Hotel Pemberton, Nantasket Beach (Boston Harbor), June 18 to 22. The following papers will be presented and discussed: "Temperature of Lakes," Desmond Fitz Gerald; "Notes on Manufacture and Properties of Malleable Cast Iron," H. R. Stanford; "Topography on the Survey of the Mexico-United States Boundary," J. L. Van Ornum; "Construction of Substructure for Lonesome Valley Viaduct, Knoxville, Cumberland Gap & Louisville R. R.," Gustave R. Tuska; "Experiments on the Discharge of a 30-in. Stop Valve," J. Waldo Smith; "Hollow Tile Floors, Past and Present," Fr. Von Emperger; "The Life of an Iron Railway Bridge," J. E. Greiner; "The Separate Sewer System Without Automatic Flush-Tanks," F. S. Odell; "Consumption and Waste of Water," Dexter Brackett; "A New Weir Formula," Charles W. Sherman. George F. Swain will give an informal address on the Boston Subway, and Frederic P. Stearns will give a brief description of the proposed Metropolitan water supply.

There will be excursions to the harbor, the city of Boston and the pumping station of the sewage works, and an excursion to the White Mountains after the convention.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The summer meeting will be held at Detroit, Mich., June 25 to 28. The following is the list of papers to be presented: "The Old and the New," Robert Allison; "A New Form of Sterilizer," A. M. Goodale; "A Portable Disinfecting Plant," W. H. Francis; "The Strength of Iron as Affected by Tensile Stress While Hot," De Volson Wood; "The Effect of Length of Specimen on the Percentage of Ductility," R. C. Carpenter; "A T-Square and Its Mountings," W. A. Gabriel; "Efficiency of Boilers," F. W. Dean; "Force Required and Work Performed in Driving and Pulling Out Wire Nails," R. C. Carpenter; "New Forms of Friction Brakes," W. F. M. Goss; "A Horse-Power Planimeter," E. T. Willis; "A Coal Calorimeter," R. C. Carpenter; "Tests to Show the Distribution of Moisture in Steam When Flowing in a Horizontal Pipe," D. S. Jacobus; "Analysis of the Tremont Turbine," De Volson Wood; "Rustless Castings for Iron and Steel" (Third Paper), M. P. Wood; "A Piece Rate System," F. W. Taylor; "The Down-Draft Furnace for Steam Boilers," W. H. Bryan; "A New Shaft Governor," E. T. Armstrong; "A Method of Proportioning the Cylinders of Compound Engines," R. C. Knapp; "Expansion Bearings for Bridge Superstructures," Geo. S. Morison; "Tests of the Experimental Engine of Sibley College, Cornell University," R. C. Carpenter; "Tests of a Combined Electric Light and Electric Railway Station," D. C. Jackson; "Pipe Covering Tests," Geo. M. Brill. The subject of tests of cast iron, which was discussed extensively at the meeting in New York last December, will be again brought up at Detroit. Mr. W. J. Keep, of the Society's committee on this subject, will read two papers, one on the "Transverse Strength of Cast Iron," and the other on "Curves Obtained During the Cooling of Cast Iron." In addition to the papers there will be topical discussions. There will be excursions to Belle Isle Park, the St. Clair Flats, of the Public Lighting Commission, and various manufacturing establishments. The sessions will be held in the Y. M. C. A. Hall, and the hotel headquarters will be in the Russell House.

INDIANAPOLIS ENGINEERING CLUB.—At the meeting of May 25 a discussion on "Wind Pressure" was led by Thos. H. Perry, Chief Engineer of the Lake Erie & Western R. R. The next meeting will be held June 8.

NEW PUBLICATIONS.

REPORT OF THE BOARD OF RAILROAD COMMISSIONERS OF IOWA.—Seventeenth Annual Report, for the Year Ending June 30, 1894. Published by the Board; W. W. Ainsworth, Secy., Des Moines, Ia. Cloth; 8vo; pp. 480.

The report shows a mileage of 8,490 miles of railway, which is 18 miles less than was reported last year, the Wabash line from Harvey to Albia, which has been abandoned for some years, not being included. The bulk of the volume is taken up by reports of proceedings in the adjustment of complaints, and tables of financial and traffic statistics. The average cost of construction is given as $30,245 per mile, and that of equipment at $2,783. The maximum net weight of freight in a train is reported as 250 tons, or about 14 loaded cars. The average train mileage per ton of locomotive fuel is 25 miles.

Principal interest in this report centers in the proceedings before the Board for an increase in the rates of freight officially fixed by the Board. Briefly told, the request of the railways for an increase of rates was refused, on the ground that they had not proved their claim that rates in Iowa were lower than those charged in other states. As this is the first proceeding of the sort on record, it is well worth careful study by every student of the railway problem.

TRADE PUBLICATIONS.

WATER-WORKS SPECIALTIES.—Pleuger & Henger Mfg. Co., St. Louis, Mo.; 8vo; cloth; pp. 174; Illustrated.

This is a well-illustrated catalogue of the large line

of plumbers' supplies and water-works specialties manufactured by this well-known firm. Among the features of especial interest to water-works engineers are the various patterns of National valve and service boxes, gate valves, and hydrants.

HYDRAULIC SPECIALTIES.—U. S. Wind Engine & Pump Co., Batavia, Ill. 8vo; pp. 56; illustrated.

The larger part of this catalogue is taken up with a description of the various windmill plants and water towers erected by the company. This is followed by a descriptive list of water-works specialties and plumbers' supplies, and a dozen or so pages of tables and other useful information regarding the capacity and operation of windmills, pumps, etc.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
June 7.	Bridge, Versailles, Ind.		Apr. 18
June 7.	Piers, etc., Detroit, Mich.		May 9
	Advertised, Eng. News, May 9 to 30.		
June 7.	Pipelaying, Syracuse, N. Y.		May 16
	Advertised, Eng. News, May 16 and 23.		
June 7.	State house, Providence, R. I.		May 16
June 7.	Public building, Rock Island, Ill.		May 16
June 7.	Paving materials, St. Louis, Mo.		May 30
June 7.	Dredging (125,000 cu. yds), Baltimore.		May 30
June 8.	Water-works franchise, Alexandria, Ind.		May 16
	Advertised, Eng. News, May 16 and 23.		
June 8.	Public bdg. approaches at Galesburg, Ill.		May 30
June 8.	Trenching, etc, Rumford Falls, Me.		May 30
June 8.	Electric lighting, Greenville, O.		May 30
June 8.	Sewage pumping station, Boston.		May 30
June 8.	Electric r'y (5 miles), Skowhegan, Me.		June 6
June 8.	Post office building at Chicago, Ill.		June 6
June 8.	Sewer, Augusta, Ga.		June 6
June 8.	Road, Tewksbury, Mass.		June 6
June 9.	Public bldg. work at Taunton, Mass.		May 16
June 10.	Electric light plant, Montreal Que.		May 9
June 10.	Building, Faribault, Minn.		May 16
June 10.	Observatory, Columbus, O.		May 16
June 10.	Interior of court house, Rochester, N. Y.		May 16
June 10.	Armory work, New York, N. Y.		May 23
June 10.	Water-works system, Forestville, N. Y.		May 23
	Advertised, Eng. News, May 23 and 30.		
June 10.	Brick sewer, Syracuse, N. Y.		June 6
June 10.	Grading, etc., Syracuse, N. Y.		June 6
June 10.	Iron tower at Calumet pierhead, Ill.		June 6
	Advertised, Eng. News, May 30.		
June 10.	Stone bridge, Media, Pa.		June 6
June 10.	Brick sewer, Toledo, O.		June 6
June 10.	Cedar block paving, Stevens P't, Wis.		June 6
June 10.	Brick paving, Michigan City, Ind.		June 6
June 10.	Paving, Latrobe, Pa.		June 6
June 10.	Laying water pipe in Boston Harbor.		June 6
June 10.	Water-works system, Amboy, Minn.		June 6
June 10.	Water-works system, St. Charles, Minn.		June 6
June 10.	Brick paving, Gloversville, N. Y.		June 6
June 10.	Pass. cars (12), N.Y. & B'klyn Bridge.		June 6
June 10.	Electric lighting, Lansingburg, N. Y.		May 23
June 10.	Paving bonds, Omaha, Neb.		May 23
June 10.	Street railway franchise, Sacramento.		May 23
June 10.	Railway 9½ miles), Rumford Falls, Me.		May 23
	Advertised, Eng. News, May 23 to June 6.		
June 10.	Water bonds ($8,000), Norwood, Mass.		May 23
June 10.	Water-tube boilers (4), Chicago.		May 23
June 10.	Earth dams, North Adams, Mass.		May 23
	Advertised, Eng. News, May 23 and 30.		
June 10.	Sewer bonds ($325,000), Youngstown, O.		May 30
June 11.	Brick paving (15,000 sq. yds.), Ithaca.		May 23
	Advertised, Eng. News, May 23 and 30.		
June 11.	Sewers, New York, N. Y.		May 30
June 11.	Macadamizing, Bound Brook, N. J.		May 30
June 11.	Roads, Upper Sandusky, O.		May 30
June 11.	Laying water pipe (24 sts.), New York.		May 30
June 11.	Water bonds ($11,400), Hibbing, Minn.		May 30
June 11.	Outlet sewer, Brooklyn, N. Y.		June 6
June 11.	Brick paving, Troy, N. Y.		June 6
June 11.	Pipe sewers, Troy, N. Y.		June 6
June 11.	Sewers, Indianapolis, Ind.		June 6
June 11.	Altering college building, New York.		June 6
June 11.	Brick paving, etc., Indianapolis, Ind.		June 6
June 12.	Public bid'g approaches at Lewiston, Me.		May 23
June 12.	Metal work, Philadelphia, Pa.		May 30
	Advertised, Eng. News, May 30.		
June 12.	Lighthouse, New Orleans, La.		May 30
	Advertised, Eng. News, May 30.		
June 12.	Street railway, Baltimore, Md.		June 6
June 12.	Iron bridge, Camden, N. J.		June 6
June 12.	Pumping plant, St. Paul, Minn.		June 6
June 12.	Iron bridges (6 contracts), Elkton, Md.		June 6
June 13.	Wooden bridge, Butte, Mont.		May 23
June 13.	Sewer, Sterling, Ill.		May 30
	Advertised, Eng. News, May 30.		
June 13.	Foundations for beacons, Cleveland.		May 30
	Advertised, Eng. News, May 30 and June 6.		
June 13.	Metal work at Marblehead, Mass.		June 6
	Advertised, Eng. News, June 6.		
June 13.	Pipe sewers, Buffalo, N. Y.		June 6
June 13.	Air lift machinery, Celina, O.		June 6
	Advertised, Eng. News, June 6.		
June 13.	Enl'gement of levee, Clarksdale, Miss.		June 6
June 13.	Pumping station, etc., Allegheny, Pa.		June 6
June 14.	Stone and brick work at Richmond, Ky.		May 23
June 14.	Bridge, Central City, Neb.		May 23
June 14.	Water-works system, Montgomery, N.Y.		May 23
	Advertised, Eng. News, May 23 to June 6.		
June 14.	Pipe sewers (10,160 ft.), Maywood, Ill.		June 6
June 14.	Cement sidewalks, Washington, D. C.		June 6
June 14.	Road impvmt bonds, Belleville, N. J.		June 6
June 15.	Irrigation canal, Portland, Ore.		Apr. 18
June 15.	Sinking wells, Norfolk, Va.		May 16
	Advertised, Eng. News, May 16.		
June 15.	Water bonds, Canandaigua, N. Y.		May 16
June 15.	Street improvements, Avondale, O.		May 23
June 15.	Sewer, Emporium, Pa.		May 23
	Advertised, Eng. News, May 23.		
June 15.	Steel bridges (2 contracts), London, Ont.		May 23
	Advertised, Eng. News, May 23 to June 6.		
June 15.	Electric l't plant, Scotland Neck, N. C.		May 30
June 15.	Railway (11½ miles), Philipsburg, Pa.		May 30
	Advertised, Eng. News, June 6.		
June 15.	Brick paving, Logansport, Ind.		May 30
June 15.	Iron cage, Pulaski, Tenn.		May 30
June 15.	Bridge masonry, Painesville, O.		June 6
June 15.	Stone culverts, L. & P. S. Ry, Ont.		June 6
June 15.	Laboratory, Wooster, O.		June 6
June 15.	Theater bldg. work, Atchison, Kan.		June 6
June 15.	Electric railway route, Marion, O.		June 6
June 17.	Building supplies, Washington, D. C.		May 23
June 17.	Electric lighting, Scottdale, Pa.		May 23
	Advertised, Eng. News, May 23 to June 13.		
June 17.	Viaduct (642 ft.), Albany, N. Y.		May 23
June 17.	Belgian block paving, Jersey City, N. J.		May 30
June 17.	Steel viaduct, Jersey City, N. J.		May 30
June 17.	Brick paving, Jersey City, N. J.		May 30
June 17.	Sewer, Rochester, N. Y.		June 6
June 17.	Sewer system, Pelham Manor, N. Y.		June 6
	Advertised, Eng. News, June 6 and 13.		
June 17.	Pipe sewers (26,000 ft.), Clinton, N. Y.		June 6
	Advertised, Eng. News, June 6.		
June 17.	Flagging (33 contracts), Brooklyn.		June 6
June 17.	Brick paving, Cincinnati.		June 6
June 18.	Paving, etc., Mattoon, Ill.		May 30
June 18.	Sale of disinfecting plant, New York.		June 6
	Advertised, Eng. News, June 6.		
June 18.	Elevators, Washington, D. C.		June 6
June 18.	Water bonds ($200,000), Portland, Ore.		June 6
June 19.	Water-works system, Pawhuska, Okla.		May 16
June 19.	Bridge mas'ry, (5 cont's), Norristown, Pa.		May 23
June 19.	Steel bridge, Ironton, O.		May 23
June 19.	School building, Cleveland, O.		May 30
June 19.	Electric lighting, Lexington, Ky.		May 30
June 19.	Sewers (6,590 ft.), Plainfield, N. J.		May 30
	Advertised, Eng. News, May 30.		
June 19.	Water-works, Independence, Wis.		May 30
June 19.	Wharf, etc., Southport, N. C.		June 6
June 19.	Electric light plant, Collingwood, Ont.		June 6
June 19.	Macadamizing (50 m.), Morristown, N.J.		June 6
	Advertised, Eng. News, June 6 and 13.		
June 19.	Water-works system, Monticello, N. Y.		June 6
	Advertised, Eng. News, June 6 and 13.		
June 20.	Electric light plant, Athens, O.		May 23
June 20.	Bridge bonds ($20,000), Dayton, O.		May 23
June 20.	Fence, Columbus, O.		May 23
June 20.	Electric light plant, Los Angeles, Cal.		May 30
June 20.	Iron bridge ,Galveston, Tex.		May 30
June 20.	Court house, Paris, Tex.		May 30
June 20.	Public bldg. work, Washington, D. C.		June 6
June 20.	Electric subway conduits, Baltimore.		June 6
June 20.	Iron bridges (2 contracts), Houston.		June 6
June 21.	Water-works system, Elmwood, Ill.		May 23
	Advertised, Eng. News, May 23.		
June 21.	Bridge superstructure, Buffalo, N. Y.		May 30
June 21.	Iron bridge, Cape Girardeau, Mo.		May 30
June 21.	Sewer, Cincinnati, O.		May 30
June 22.	Road improvement, Cincinnati, O.		June 6
June 24.	Court house plans, Denton, Tex.		May 30
June 24.	Garbage disposal, Washington, D. C.		May 30
June 24.	Iron piles, San Francisco, Cal.		June 6
June 24.	Paving, Piqua, O.		June 6
June 25.	Water-works system, Wapakoneta, O.		June 6
	Advertised, Eng. News, June 6 and 13.		
June 26.	Court house and jail, Swainsboro, Ga.		May 16
June 26.	Street r'y franchise, Los Angeles, Cal.		June 6
June 26.	Macadamizing at Fort Crook, Neb.		June 6
June 27.	Jetty work, Montgomery, Ala.		May 16
	Advertised, Eng. News, May 16 to June 6.		
June 28.	Building, Faribault, Minn.		June 6
June 28.	Hire of dredge, New Orleans, La.		June 6
June 29.	Wooden bridge, Cape Girardeau, Mo.		June 6
July 1.	Water-works system, Deckertown, N. J.		May 30
	Advertised, Eng. News, May 30 to June 13.		
July 1.	Water-works system, Cullman, Ala.		May 30
July 1.	Crib dike, Wilmington, Del.		June 6
July 1.	Water supply, Jersey City, N. J.		June 6
July 1.	Road construction, Bristol, Me.		June 6
July 2.	Brick paving, Van Wert, O.		May 30
July 2.	Water-w'ks franchise, Greenville, Miss.		May 30
July 3.	Bridges, Uklah, Cal.		Apr. 18
July 6.	Jail cells, Auburn, Cal.		May 16
July 8.	Courthouse, Baltimore, Md.		May 9
	Advertised, Eng. News, May 9 to 23.		
Aug. 2.	Electric lighting, El Paso, Tex.		May 23
Aug. 5.	Plans for state capitol, St. Paul, Minn.		Apr. 25
Oct. 1.	Plans for art building, Philadelphia, Pa.		May 23
	Advertised, Eng. News, May 23 to June 27.		
No date.	Engine and dynamos, Newark, N. J.		May 30
	Advertised, Eng. News, May 30 to June 20.		
"	.Artesian well, Statesboro, Ga.		June 6
"	.Foundry building, Hamilton, O.		June 6

RAILWAYS.

East of Chicago.

BATAVIA & NORTHERN.—Surveys have been completed for this railway form Batavia, N. Y., to Lake Ontario, and press reports state that contracts will soon be closed for the construction. Pres., Wm. H. Hazard; Vice-Pres., Jacob Cole; Secy., Geo. A. Wingate; Ch. Engr. and Man., Robt. Schermerhorn, all of Brooklyn, N. Y.

CENTRAL.—James Barnes, of Buctouche, is reported to have been awarded the contract for extending this railway from Chipman to Newcastle, N. B.

CHICAGO & WEST MICHIGAN.—The awarding of the contract for an extension of this railway was noted last week under Contract Prices. J. J. McVean, Ch. Engr., Grand Rapids, Mich., writes us as follows: This seven-mile extension is the extension of a branch road, now 2½ miles long, from a station called Clary, on the main line, to Turtle Lake, and the extension runs from Turtle Lake seven miles northwesterly in the county of Benzie to the location of a mill which is being erected by the Guelph Patent Cask Co., of London, England, which has purchased a large tract of hardwood timber land in that vicinity, and is making it into veneering, which is shipped to England, and there manufactured into casks or barrels. The company has platted a town called Honor, and is building a mill. This seven-mile extension is to reach it simply as a siding or branch line, to do freight business over only. The grades in some places are as heavey as 2%, and the curves are 10° in some cases, it following down a narrow valley between the hills to the Platte River, on which the town of Honor is located. The work has been let to McDonell Bros. & Co., of Grand Rapids, to do the clearing, grubbing, grading, construction of culverts, laying track and surfacing the same ready for use at the rate of $1,643 a mile.

CINCINNATI, JACKSON & MACKINAW.—A press report from Jackson, Mich., states that a surveying party in charge of Isaac Dox, of Lockport, N. Y., has been engaged for several days in surveying a line for the C., J. & M. from Addison to Jackson, via. Brooklyn. The construction of the extension depended upon the decision of the company as to which terminal it preferred to build first, this one or the one into Cincinnati. Mr. Dox has plans prepared for a long tunnel into the latter city.

CONCORD & ROCHESTER.—The Concord, N. H., "Monitor" states that a movement is on foot in that city to push the survey and construction of this proposed road. A charter was secured in 1891 to build the line, which will run through Chichester, Pembroke, Epsom, Northwood, Stafford and Barrington, and it is now proposed to make an early survey of the route.

JAMESTOWN & LAKE ERIE.—It is stated at Jamestown, N. Y., that arrangements have been about completed for extending this railway to Brooklyn Square, where a large passenger station will be erected. The extension will be along the bank of the Chadakoin River.

LONDON & PORT STANLEY.—Bids are asked until June 15 for the construction of two stone culverts and embankments on this railway near St. Thomas, Ont. Ormsby Graydon, Resident Engr., London, Ont.

LORAIN & WELLINGTON.—This company was recently incorporated by J. S. Steele, of Oberlin, O., and others, but we are informed by Jas. B. Hoge, Lorain, O., that no permanent organization has been effected as yet.

MILLERSBURG, ASHLAND & GREENWICH.—H. B. Camp, Pres., Akron, O., is negotiating with the citizens of Jeromeville, O., looking toward the early completion of this railway between Greenwich, Ashland, Jeromeville and Shreve, O. About eight miles were completed several months ago. Ch. Engr., John H. Hall, Canton, O.

NEW YORK CENTRAL & HUDSON RIVER.—Work has been commenced, according to reports, on an extension of the Carthage & Adirondack road from Benson Mines, N. Y., to Newton's Mill, a distance of 3½ miles.

NORTHERN NEW YORK.—Incorporated in New York May 26 as a reorganization of the Northern Adirondack, which had been in the hands of the Franklin Trust Company, of New York city, for several years. The trust company has sold it to the new company under foreclosure proceedings. The road extends from Moira to Tupper Lake, in Franklin county, with a branch from Black Rapids Junction to Black Rapids, and is about 56 miles long; capital stock, $1,000,000; directors, Charles E. Arnold, Alfred J. Voyer, of Albany; Frank L. Sniffin, Crowell Hadden, James L. Cowing, and George H. Southard, of Brooklyn; Charles C. Couthard, of Plainfield, N. J., and George I. Humphreys, of Saratoga.

PHILADELPHIA & READING.—It is reported that this company is about to resume work on an unfinished tunnel at Tower City, Pa., work on which was started about 40 years ago. The tunnel would extend through the mountain to Ranch Gap, and open up a rich tract of coal land.

PITTSBURG & EASTERN.—Philadelphia papers state that the contract for the construction of the first division of this railway has been awarded to P. McManus, of Philadelphia. The division, which is 18 miles long, extends from Mahaffey, Clearfield county, to Rankin Summit. The construction is to be commenced at once, and the line ready for operation by Oct. 1. It will develop the Cush Creek and Glen Campbell coal districts, and open up large timber tracts near Burnside, Clearfield county. The second division of the road will be 45 miles long, and extend to Saltsburg, Indiana county. The contract for its construction will probably be given out later in the season. The company's office is in the Bullit building, Philadelphia.

PITTSBURG, CINCINNATI, CHICAGO & ST LOUIS.—It is reported at Elwood, Ind., that this company is considering the building of a line from Frankton, six miles south of Elwood, northeast to Gas City, where it will connect with the company's lines. The route was surveyed last summer, and passes through Orestes, crossing the Lake Erie & Western at that place. It will also pass through Summitville. Already three factories, employing 1,000 men, have been secured at Orestes on the strength of the new road coming.

RUMFORD FALLS & RANGELEY LAKES.—Bids for an extension of this railway are now being received, as stated in our advertising columns. Galen C. Moses, Pres., Bath, Me., writes us that about 18 miles of the line is graded, and that tracklaying is now under way by Ward Bros., the contractors.

SEBASTICOOK & MOOSEHEAD.—The Portland, Me., "Advertiser" states that C. C. Brown has gone to St. Albans, Me., to resume work on the survey for an extension of this railway. Pres. and Gen. Man., Z. D. Lancaster, Fredericton, N. B.

SKANEATELES.—The Syracuse, N. Y., "Courier" states that negotiations are pending for the purchase of this railway by a party of New York men, who propose to extend it along Skaneateles Lake to Cortland, and possibly north to Jordan. Luzern Williams, a railway contractor of Syracuse, is interested.

TOLEDO, ANN ARBOR & NORTH MICHIGAN.—This company is reported to have accepted a bonus of $10,000 to make certain changes in its line. Ch. Engr., H. E. Riggs, Toledo, O.

TOELDO, HAMILTON & BUFFALO.—This road was noted last week. A press report from Hamilton, Ont., states that Andrew Onderdonk, of Chicago, was the lowest bidder for the construction of a $300,000 tunnel to be constructed by the company at the west end of Hamilton.

UNADILLA VALLEY.—It is stated that about 150 men are at work on this road between South Edmeston and New Berlin, N. Y., and that the grading is about completed.

WISCASSET & QUEBEC.—The town of Albion, Me., has voted to take $7,000 in bonds to secure the construction of this road to that place. Pres., R. T. Rundlett, Wiscasset, Me.

Southern.

ATLANTIC, FLORIDA & GULF.—Press reports from Kissimmee, Fla., state that C. C. Smith, Vice-Pres., is now in New York, but is expected to return to that city this week, and that active construction will then be commenced. The survey runs from Cape Canaveral, or Rockledge, west by south, passing at or near Narcoossee, and crossing the Kissimmee River at Fort Gardner, then on to Bartow. Narcoossee is connected with Kissimmee by the Sugar Belt railway. Later branches will be run from Fort Gardner south, opening up a large and fine section of Florida. Kissimmee is connected with Fort Gardner by two steamboat lines, which run from Kissimmee to Fort Bassinger, a distance of 200 miles.

COLUMBUS, HUNTINGTON & GUYANDOTTE.—The Charleston, W. Va., "Gazette" states that the

counties of Cabell, Lincoln, Logan, Wayne and Wyoming have all ordered elections to be held this month to decide upon the question of issuing bonds to aid in building this railway from Huntington, on the Ohio River, up the valley of the Guyandotte River, in West Virginia. J. L. Caldwell, of Huntington, W. Va., is interested.

HALO HARDWOOD CO.—It is reported that this company has contracted to build ten miles of railway, beginning at Sutton, W. Va., and following Laurel Creek two miles, thence up Big Run five miles, thence up Elk River three miles. The road will be for the primary purpose of getting logs to the company's mills at Sutton, but it is contemplated to open it for general traffic later.

LEXINGTON & EASTERN.—The Lexington, Ky., "Leader" states that G. M. Boas, of New York, has been sent to Kentucky by W. L. D. Waldridge, Pres. American Coal Co., to make surveys for a branch line of this railway in Eastern Kentucky. Gen. Man., J. D. Livingston, Lexington, Ky.

LIVE OAK & GULF.—J. R. White, Secy., Citra, Fla., writes us that this railway is projected from Live Oak, through Limaville and Mayo, Fla., to Dead Man's Bay, a distance of 80 miles. Pres., R. L. Anderson, Citra, Fla.; Ch. Engr., J. R. Moorhead, Ocala, Fla.

LOUISVILLE & NASHVILLE.—J. W. Worthington & Co., of Birmingham, Ala., have been awarded the contract for building the Coosada branch of this railway. It will be about 15 miles long, extending from a point on the main line a short distance below Coosada, and some miles north of Montgomery, to the mines at Prattville.

MOUNDSVILLE, BENWOOD & WHEELING.—Incorporated in West Virginia May 27 to build a railway between Moundsville & Wheeling; capital stock, $250,000, commencing with $125; incorporators, J. W. Burchinal, A. D. Pierce, M. F. Cox and B. F. Peabody, of Moundsville, W. Va., and P. B. Dobbins, of Wheeling, W. Va.

VIRGINIA, FREDERICKSBURG & WESTERN.—We are informed that two field corps are in the field on the location of that part of the line between Fredericksburg, Va., and the Chesapeake Bay. The projected length is 220 miles. Ch. Engr., Wm. A. Hankins, of Hankins, Mosby & Co., Richmond, Va.; Secy., F. L. Rodgers, Bridgeport, Conn.; Pres., Wm. C. Haight, Bridgeport, Conn.; general offices, Mills Building, 35 Wall St., New York.

Northwest.

DULUTH, HURON & DENVER.—This railway was projected and considerable grading done in the vicinity of Sauk Center, Minn., some six years ago. It is stated that Wm. Fowlds, of Chippewa Falls, Wis., has secured control of the roadbed and is considering plans for completing the construction.

GULF, SEDALIA, DULUTH & NORTHERN.—A press report from Fairfield, Ia., states that Dr. W. H. Aylesworth is arranging to build this railway from Glasgow, Mo., through Iowa, and that Ottumwa, Oskaloosa, Marshalltown, Iowa City and other places are trying to secure the line; also that Keosauqua offers a bonus of $40,000 for the road.

MINNEAPOLIS & ST. LOUIS.—The Des Moines, Ia., "Leader" states that this railway, which was recently sold by a receiver, will be extended from Angus or Perry southward, crossing the Des Moines, Northern & Western a mile or two east of Redfield and the Rock Island between Dexter and Stuart. Thence it will run southwest, passing through or near Greenfield and south to Kansas City. The line will be called the Minneapolis & Kansas City, but is believed to be an extension of the Minneapolis & St. Louis, now built from Minneapolis to Angus. The line is an easy one to build, except some heavy grades between the Rock Island and Greenfield.

TERRE HAUTE, OLNEY & CHESTER.—F. N. Boyer, Gen. Man., Olney, Ill., writes us that contracts for grading the first 58 miles of this railway will be ready to be awarded about July 1. The line is projected from Terre Haute, Ind., through West York, Oblong, Olney, Enterprise, Clsne and Johnsonville to Mount Vernon, 125 miles. Pres., John N. Horner; Ch. Engr., Thos. A. Hardman, both of Olney, Ill.

VALLEY TERMINAL.—This project was noted in our issues of May 16 and 23. Surveys for the road have been commenced by D. C. Dunlap, Ch. Engr.

WINNIPEG & HUDSONS BAY.—It is reported that Porter Bros., of Duluth, have been awarded one of the subcontracts on this railway, noted in our issue of May 9 and 16.

WINONA & WESTERN.—Contracts will be awarded at once, according to reports, for a two-mile extension from Bear Creek to Altura, on the top of the ridge. Ch. Engr., G. M. Willis; Pres., H. W. Lamberton, Winona, Minn.

WISCONSIN, CENTRAL.—This company is reported to have been granted an important franchise by the city council of Manitowoc, Wis. The franchise was granted to the Manitowoc Terminal Co. It is expected that large coal docks and terminal facilities will be built, and the construction of the line commenced as soon as possible. Ch. Engr., R. B. Tweedy, Milwaukee, Wis.

Southwest.

CENTRAL LOUISIANA.—Hampden Story, Pres., Rayne, La., writes us that surveys are about completed and the right of way partially secured for this railway from Abbeville, through Crowley, Church Point, Opelousas and Washington to Palmetto, 70 miles. Contracts will be let as soon as specifications and estimates are completed. Ch. Engr., Wilman Bradford, Rayne, La.

CHESTER & IRON MOUNTAIN.—A. J. Cooper, J. A. Reeves and A. S. Appleton, of Chicago, are reported as intending to build 70 miles of railway in Missouri, from Chester, through Farmington and Irondale, to Bismarck, touching Ste. Genevieve and St. Mary's. The road will be built over the old roadbed of the Chester & Iron Mountain line, which is now being straightened up and regraded, and will be completed by January, 1896. Mr. Cooper is quoted as stating that they have already let the contracts for a large portion of the line, and expect to give out the remainder within 10 days. The new road will tap the copper and lead mines at Flat River, the limestone quarries near Ste. Genevieve and will also supply coal from the Chester coal fields to the mines all along its route. It will enable the company to put in fuel at a greatly reduced rate at Flat River and thereabouts. Eventually it is hoped to extend the line to Fort Scott, Kan.

CHOCTAW, OKLAHOMA & GULF.—The grade is completed between Oklahoma City and South McAlester, and it is reported that the tracklaying will be completed within a few weeks.

KANSAS CITY & NORTHERN.—The organization of this company was noted last week. The company has been incorporated in Missouri to build a railway from Kansas City to the Iowa line at or near the northwest corner of Harrison county, Mo., a distance of about 100 miles. It will pass through the counties of Jackson, Clay, Ray, Clinton, Caldwell, DeKalb, Gentry, Daviess, Grundy, Mercer and Harrison; capital stock, $1,000,000; incorporators, A. F. Nathan, Robert Gillham, F. A. Faxon, Frank Cooper, C. A. Braley, A. E. Stillwell and J. McD. Trimble.

KANSAS CITY, PITTSBURG & GULF.—Kansas City papers state that A. Monroe, of Lawrence, Kan., and S. N. Lee, of Excelsior Springs, have been awarded a contract for a 70-mile extension south from the Arkansas River, near Fort Smith, Ark. The contract calls for the grading of the roadbed, the building of the wooden bridges and trestles of the substructure of the steel bridges for the 70 miles covered by the contract. The contractors will receive $4,000 a mile and expect of have the work done in five months. This makes three such contracts on the Southern branches of the road. Contractor Lindsay is grading the extension from Texarkana to Shreveport, while Contractor Corrigan is pushing the work of preparing the roadbed for the rails on the line from Siloam Springs to the Arkansas River, where this last extensions begins. When these extensions are finished the mileage of the road will be increased 300 miles.

LOUISIANA.—H. T. Beauregard, Arabi, La., writes us that some of the residents of Saint Bernard parish have obtained a franchise for a railway on the river front in that parish, but that it is only a project at present.

MISSOURI, KANSAS & TEXAS.—Efforts are being made at Columbia, Mo., to secure a branch of this road from Kennard to Columbia, Mo., eight miles. A prominent land owner has agreed to furnish right of way, and the citizens of Columbia will give a bonus. The extension is estimated to cost $100,000.

NEWPORT, BONNERVILLE & KANSAS CITY.—The incorporation of this company was noted last week. G. K. Stephens, of Brinkley, Ark., and C. H. Williams, of Newport, Ark., two of the incorporators, are reported to have contracted to build the road. Ch. Engr., D. W. Darrow, Newport, Ark.

ST. LOUIS, AVOYELLES & SOUTHWESTERN.—It is expected that 30 miles of this railway, between Simmsport and Baton Rouge, La., a distance of 65 miles, will be completed this year. About 14 miles had been graded in March. Pres., F. M. Welch, Marksville, La.; Ch. Engr., I. W. Sylvester, Alexandria, La.

ST. LOUIS & MERAMEC RIVER.—Incorporated in Missouri, May 31, with a capital stock of $750,000, commencing with $700, by Thos. Howard, J. B. Case, M. C. Orton, J. P. Dawson, T. M. Gallagher and J. A. Holmes, of St. Louis, and F. H. Prentiss, of Chicago. Some of these incorporators were also incorporators of the Howard Construction Co., which proposes to build an electric railway, as noted last week under Street and Electric Railways.

VINING & COLEMAN.—Will L. Vining, Pres., Austin, Tex., writes us that contracts for constructing this railway between Overall and Vining, 20 miles, will be awarded about June 10. The surveys have been completed, right of way secured and capital stock all subscribed. Ch. Engr., John W. Maxcy, Austin, Tex.

Rocky Mt. and Pacific.

BURLINGTON & MISSOURI RIVER.—It is stated that the alliance between the Northern Pacific and the Great Northern may necessitate changes in the traffic contract between the Great Northern and this company, and press reports state that this company has a corps of surveyors in the field locating an extension of its road west to Puget Sound.

COLORADO, WYOMING & GREAT NORTHERN.—It is reported that a construction company has been organized to build this road with H. C. Woodworth, of Denver, Colo., as president; M. Lipman, of Philadelphia, Pa., vice-president, and H. A. Woodworth, of Denver, secretary. It has been decided to issue $6,000,000 in bonds, and it is stated that Eastern capitalists have offered to advance a loan of 80% on bonds covering the first 100 miles of road, which is projected to run from Grand Junction, Colo., to Grand River, Wyo.

EVERETT, PORT ANGELES & PACIFIC.—J. S. Coolican, Pres. Port Angeles (Wash.) board of trade, has been in the East several weeks and is quoted as stating that he has secured sufficient capital to insure the building of this railway, which will shorten the distance from Victoria and Everett, the terminus of the Great Northern, 90 miles. It is proposed to run a ferry from Everett to Port Ludlow, thence 43 miles of railway to Port Angeles, and then a ferry to Victoria.

FLORENCE SOUTHERN.—The permanent survey for this road was commenced May 22. The road will be 32 miles in length, and will cost about $550,000. W. E. Johnson, J. A. McCandless and W. K. Johnson, of Florence, Colo., were among the incorporators. It was reported some time ago that Orman & Crook, of Pueblo, Colo., who built the Florence & Cripple Creek road, would also build this one.

KALSO & SLOCAN.—Foley Bros. & Guthrie, of St. Paul, have commenced work on this railway in British Columbia. The line will be extended beyond Three Forks to Sandon.

KLICKITAT VALLEY.—Incorporated in Washington May 18, to build a narrow gage railway from Lyle to Goldendale, 30½ miles; capital stock, $100,000; incorporators, G. H. Baker, N. B. Brooks, Jacob Richardson, Joseph Nesbitt, O. D. Sturgess, J. B. Curren, of Goldendale, Wash.; Peter Ahola and Al. R. Graham, of Centerville; G. W. Smith, of the Grand Dalles; A. M. Balfour, of Lyle, and John Corkish, of Portland, Ore. Surveys have been made, and it is expected to begin construction soon.

PHOENIX, TEMPE & MESA.—The town council of Tempe, Ariz., has granted a franchise for this road, to Colonel Masten, who agrees to commence the construction within 90 days, and complete it within 30 days thereafter, according to the Tempe "News."

PUEBLO & SILVER CLIFF.—Organized at Denver, Colo., with a capital stock of $300,000. Chn., Benj. Mattice; Secy., John D. Lockin. A rough survey of the line was made several years ago.

TACOMA & SEATTLE AIR LINE.—Henry Bucey, one of the incorporators of this company several years ago, has revived the project and hopes to have the road built at an early date. It would be about 30 miles long and is estimated to cost $600,000.

UTAH & CALIFORNIA.—Thomas Taylor, of Cedar City, Utah, a prominent official of the Mormon Church, writes us that he has partly succeeding in laying the foundation for organizing a company to build a railway from Milford, Utah, to San Diego, Cal. It is stated that W. H. Carson, Mayor, San Diego, will subscribe his Belt Line road and a water front property, valued at $5,000,000 to the project.—Geo. Q Cannon, Frank J. Cannon and other wealthy residents of Salt Lake City were in St. Louis recently trying to secure assistance for a railway from that city to San Pedro, Cal., 630 miles. It is stated that the Utah people, principally prominent members of the Mormon Church, propose to build 550 miles of the road at an estimated cost of $7,000,000, and that the Los Angeles Terminal Ry., a St. Louis enterprise, is asked to build the other 140 miles.

Foreign.

TEHUANTEPEC.—The Mexican Congress is reported to have ratified a contract with Samuel Hermanos, 54 Broad St., New York, for $2,000,000 worth of rolling stock and equipment, including bridges, etc., for this road.

STREET AND ELECTRIC RAILWAYS.

SKOWHEGAN, ME.—Bids are asked until June 8 for the construction of about five miles of electric railway in the towns of Skowhegan and Madison. Contracts for an additional six miles will be awarded a few weeks later. E. E. Greenwood, Engr., Coburn Block. (The advertisement for the above work was one of those received by us on Wednesday of last week; too late for insertion. Ed.)

MANCHESTER, N. H.—The Manchester St. Ry. Co. has been granted permission to cross the Concord & Montreal R. R. in the construction of its electric road to Lake Massabesic. Gen. Man., N. H. Walker.

NASHUA, N. H.—The Nashua St. Ry. Co. has been granted permission to issue new stock and bonds for the extension of its electric road to the state line to connect with the electric railway from Lowell, Supt. H. F. Webster.

NATICK, MASS.—It is reported that the Natick Electric St. Ry. Co. is to extend its road to Woodville, estimated to cost $20,000, and that the road will probably later on be extended to Westboro. Gen. Man., T. T. Robinson.

NORTH ABINGTON, MASS.—Josiah Reed, of South Weymouth, has been granted a franchise for an electric railway from Weymouth to Hingham, work on which, it is reported, will begin at once.

WINCHESTER, MASS.—The Mystic Valley St. Ry. Co. has been organized to build an electric railway between this place, Arlington and Stoneham. Geo. S. Littlefield, R. H. Bowman, E. K. Boynton and A. B. Coffin are interested.

BROOKLYN, N. Y.—The Kings, Queens & Suffolk Co. states that work will soon begin on the construction of the first section of its bicycle road between Brooklyn and Far Rockaway, estimated to cost $1,200,000. Pres., Frederick W. Dunton, 106 Fulton St., New York.

BUFFALO, N. Y.—The Buffalo & Niagara Falls Electric Ry. Co. and the Buffalo & Tonawanda Electric Ry. Co., have been consolidated, forming the Buffalo & Niagara Electric Ry. Co., with a capital stock of $1,250,000. The route of these two railways forms a continuous line, but neither road has yet been constructed. The directors of the consolidated company are W. Caryl Ely, Charles B. Gaskell and Burt Van Horn, Jr., of Niagara Falls; Robert L. Fryer, Henry H. Pierce, George H. Dunbar, and John J. McWilliams, of Buffalo; Frank A. Dudley, of Niagara Falls, and Willard P. Whitlock, of Elizabeth, N. J.

NEW YORK, N. Y.—The Third Ave. R. R. Co. has been granted a franchise for an extension of its road to Kingsbridge.—The Columbus & Ninth Ave. R. R. Co. and the Ninth Ave. R. R. Co. have filed certificates for extensions of their roads.—The Southern Boulevard Ry. Co. has petitioned for permission to equip its horse railway with electricity.

NEW YORK, N. Y.—Local papers state that the General Electric Co. has submitted plans to the Manhattan Ry. Co. for equipping its elevated road with electricity at an estimated cost of from $2,000,000 to $3,000,000.

NIAGARA FALLS, N. Y.—Crage & Tench, contractors, of Buffalo and Lewiston, write us that rapid progress is being made on the gorge branch of the Niagara Falls & Lewiston Electric R. R., which will be seven miles in length. Work was begun six weeks ago, and the roadbed is ready for the ties from Lewiston to the whirlpool, and the tracklaying will commence at once. The contractors have 800 men at work. Pres., Capt. J. M. Brinker, of Buffalo; Ch. Engr., George Bicker, of Buffalo.

SING SING, N. Y.—It is reported that the New York, Elmsford & White Plains Ry. Co. proposes to extend its electric road to Silver Lake, in Harrison Park, and that the Ossining Electric Ry. Co. is considering a proposed extension to Pleasantville.

SYRACUSE, N. Y.—The Syracuse St. R. R. Co. has been petitioned to extend its electric road to Woodlawn. Ch. Engr., H. S. Newton.

ALLEGHENY, PA.—The Fort Pitt St. Passenger Ry. Co. has been incorporated, with a capital stock of $50,000, by Joshua Rhodes.

ALLEGHENY, PA.—The Gross St. Ry. Co. has been incorporated to build an electric railway; capital stock, $6,000; Pres. Wm. B. Rhodes.—The Coraopolis, Sewickley & Economy St. Ry. Co. has been incorporated to build an electric road; capital stock, $50,000; Pres., C. I. McDonald, of Allegheny; directors, John S. Duss, of Economy; John C. Whitla, of Beaver Falls.

PITTSBURG, PA.—The Negley St. Ry. Co. has been

incorporated to build an electric railway in Pittsburg; capital stock, $6,000; Pres., Wm. H. Latshaw, of Pittsburg; director, Wm. B. Rhodes, of Allegheny.

READING, PA.—O. Nicaulenbach, Secy., writes us that the Reading & Womelsdorf Electric Ry. is now being built between West Reading, Sinking Spring, Wernersville, Robesonia and Womelsdorf, a distance of 14 miles. The road will be finished to Sinking Spring in 30 days. Pres., John A. Rigg; Ch. Engr., W. S. Davis.

CRISFIELD, MD.—Thos. H. Bock, of Cohn & Bock, of Princess Anne, is reported as interested in a projected electric railway from Princess Anne to Deals Island, a distance of 16 miles.

BALTIMORE, MD.—Bids are asked until June 12 for building the Baltimore, Middle River & Sparrow's Point R. R., from 15th St. and Eastern Ave. to Baltimore St. and city line. Pres., James Young; Ch. Engr., Chas. B. McClean.

WASHINGTON, D. C.—It is reported that the Washington & Great Falls Electric Co. proposes to issue $500,000 in bonds to build a railway from this city to Cabin Johns Bridge on the Potomac River. Stilson Hutchins is interested.

PORTSMOUTH, VA.—The Portsmouth St. Ry. Co. is reported as about to equip its road with electricity, at an estimated cost of $200,000. Ch. Engr., C. H. Davis.

JACKSONVILLE, FLA.—The construction of the Jacksonville & Tampa Bay Improved Ry. Co.'s proposed electric road will probably soon be commenced. T. J. Appleyard, of Tallahassee, is interested.

CLARKSVILLE, TENN.—The question of equipping the Clarksville St. Ry., four miles in length, with electricity is being considered. Supt., T. A. Small.

BOWLING GREEN, KY.—It is reported that an electric railway 4½ miles in length is soon to be built. M. H. Crump is interested.

BUCYRUS, O.—M. J. Monnette, Pres., writes us that one line of the Inland Electric Ry. from Annapolis to Tyre and Shelby has been built. The franchise for the entire road, 23 miles in length, will soon be complete.

OAKLEY, O.—The Oakley & Cincinnati St. R. R. Co. has been incorporated, with a capital stock of $10,000; incorporators, R. J. H. Archiable, John Rempe, H. P. Sabbert and Edwin E. Schneider.

LORAIN, O.—The East Lorain St. R. R. Co. has been incorporated to build an electric railway in Cuyhoga county; capital stock, $25,000; incorporators, Wm. J. Garone, William McReynolds, John A. Park and Edward S. Meyer.

MARION, O.—Bids are asked until June 15 for constructing and operating street railway route No. 5. James Williams, Cy. Clk.

INDIANAPOLIS, IND.—The Indianapolis, Anderson & Marion Ry. Co. has been incorporated to build an electric railway in Marion, Hancock, Madison and Grant counties; capital stock, $500,000; incorporators, N. J. Clodfelter, of Crawfordsville; A. B. Wilgus, of New York; V. C. Quick, of Alexandria, and W. R. Myers, of Indianapolis.

KOKOMO, IND.—It is reported that Ellsworth Hunt, County Surv., has been making surveys for an electric railway between this city and Greentown.

HIGHLAND PARK, MICH.—Thomas Johnson, of the Citizens' St. Ry. Co., of Detroit, has petitioned for a 50-year franchise in this place.

ANNA, ILL.—The Citizens' Electric Light & St. Ry. Co. has been incorporated, with a capital stock of $12,000, by Chas. V. Nordling, Christian Nordling and John C. Nordling.

JANESVILLE, WIS.—It is reported that the Janesville St. Ry. Co. is considering the question of either abandoning or extending its electric railway. Ch. Engr., A. Gibson.

MILWAUKEE, WIS.—The Milwaukee St. Ry. Co. has decided to extend its electric railway to the state fair grounds, work on which will commence at once, as the road is to be completed by July 4. Gen. Man., C. D. Wyman.

BURLINGTON, IA.—The Burlington Ry. Co. has been organized to build an electric railway to West Burlington, a distance of five miles; capital stock, $150,000; G. H. Higbee, J. J. Ransom and John T Remey are interested.——S. D. Eaton has been engaged to make surveys for the extension of the Burlington Electric Ry. Co.'s road to West Burlington. Supt., C. D. Jones.

LEAVENWORTH, KAN.—Newman Erb, of New York, is reported as making preparations for changing the route of the Third St. branch of the Leavenworth Electric Ry., so that it will run directly into Fort Leavenworth. Gen. Man., L. M. Erb.

ST. LOUIS, MO.—The St. Louis & Meramec River R. R. Co. has been incorporated to build a road from Sarah St. to Webster Groves. The franchise granted the Meramec River R. R. Co. in 1893 has been transferred to the new company, and the capital stock has been increased from $500,000 to $750,000; incorporators, Thomas Howard, J. B. Case, John A. Holmes, M. C. Orton and James P. Dawson.

LOS ANGELES, CAL.—Bids are asked until June 26 for the purchase of an electric street railway franchise. T. E. Newlin, County Clk.

ELECTRIC LIGHT AND POWER.

WHITE PLAINS, N. Y.—It is reported that bids are being asked for 50 arc and 175 incandescent lights, or for 175 gas lamps for three years.

NEWARK, N. J.—Press reports state that all the holdings of the New York and Philadelphia capitalists in the Newark Electric Light & Power Co. have been sold to a new company, which expects to furnish light throughout the state. The authorized capital of the new concern is $2,000,000, of which $50,000 will be issued at once. New apparatus will be employed by which electric light may be furnished at a greater distance than by the old machinery.

RED BANK, N. J.—Philip N. Jackson, of the Newark Electric Light Co. and others are reported as organizing an electric light comapny, with a capital stock of $28,000.

BALTIMORE, MD.—Bids are asked until June 20 for constructing about 45,000 ft. of electrical subway conduits. Engr., Nicholas S. Hill, 508 Equitable Bldg.

FRANKLINTON, N. C.—We are informed that the new cotton mill now being erected at this place will probably put in an electric light plant as a part of the equipment of the mill, as soon as the mill buildings are completed. Address Col. W. F. Green.

MOUNTAIN ISLAND, N. C.—A correspondent writes us that the Mountain Island Cotton Mill Co. will put in an electric light plant at its factory at once.

SANDERSVILLE, GA.—An election will be held July 15 to vote on the question of issuing $15,000 in bonds for an electric light plant and a water-works system.

NORWALK, O.—An election will probably be held soon to vote on the question of issuing $25,000 in bonds for an electric light plant.

INDIANAPOLIS, IND.—A new electric light company is reported as being organized to supply 10,000 lights besides power contracts. R. T. McDonald, T. H. McLain, R. C. Light and Leon O. Bailey are interested.

DURAND, ILL.—It is reported that a Chicago company has been awarded a 30-year franchise by the council for electric lights, and that a $10,000 plant will be put in at once.

MILWAUKEE, WIS.—A committee is considering the question of buying the Badger Illuminating Co.'s plant, which originally cost $380,000, or building a new plant at an estimated cost of $385,000. Geo. H. Benzenberg, Cy. Engr.

KASSON, MINN.—The construction of an electric light plant to light this place and Mantonville is being considered, according to reports. Water power will be used.

WILMAR, MINN.—The citizens have voted to erect an electric light plant, estimated to cost $8,000.

ROCKWELL CITY, IA.—It is reported that an electric light company will probably petition for a franchise.

NORTONVILLE, KAN.—It is reported that a company is being organized to put in an electric light plant.

FREMONT, NEB.—It is reported that work will be commenced at once on the construction of a municipal electric light plant.

LEXINGTON, MO.—Thomas Wolfe & Co., of Kansas City, have been granted a franchise for an electric light plant.

LOS ANGELES, CAL.—Charles Story, Engr., estimates the cost of putting in an electric light plant for the city hall at $2,800.

COLLINGWOOD, ONT.—Bids are asked until June 19 for extending and improving the electric light plant. Consult. Engr., Geo. W. Fraser, Imperial Loan Bldg., Toronto; James Guilfoyle, Chn. Com.

NEW COMPANIES.—La Harpe Electric Light & Power Co., La Harpe, Ill.; $15,000; Joseph R. Crabill, George Coulsen and W. O. Buelen.

Pugh Electric Light & Power Co., Cincinnati, O.; $5,000; A. H. Pugh, Alfred Mack, Geo. W. Pickard, John Galvin.

Globe Electrical Co., Detroit, Mich.; $10,000, with $3,600 paid in; William H. Palmer, Scott H. Morris, Friend Palmer.

West End Electric Light & Power Co., West Hazleton, Pa.; $10,000, wth $1,000 paid in; Treas., Conrad H. Linderman, Hazleton.

Tillman Portable Electric Light & Reflector Co., New York, N. Y.; $100,000; H. A. Ockershawsen, J. J. Lawley, T. A. Foy, Paul Brunel.

Guayaquil General Electric Co., New York, N. Y.; $150,000, with $100 paid in; M. de J. Alvarado, J. L. Ullo, Brooklyn, N. Y.; Vicente Hawrie-Emes, G. F. Woolston, F. E. Rogers, New York.

Hamilton & Lake Erie Power Co., Hamilton, Ont.; to build a power canal from the Welland Canal about 20 miles from its junction with the Niagara River; Alexander Manning, S. F. McKinnon, H. M. Pellatt, Toronto; Frederick Dillbaugh, Hamilton, Ont.

BRIDGES.

BUXTON, ME.—The Boston Bridge Works has been awarded the contract for building a 127-ft. span bridge at Salmon Falls, to take the place of one recently carried away by high water.

WEST LEBANON, N. H.—It is reported that Lyman's bridge over the Connecticut River, between this place and Hartford, Vt., will be rebuilt at a cost of about $20,000.

BOSTON, MASS.—We are informed that the following bids have been received by B. T. Wheeler, Supt. of Streets, for work on the Chelsea Bridge, North; H. B. Woods, Executive Engr.:

Rebuilding Draw Foundation.		
Augustus Belleone & Co., Boston, Mass.		*$19,260
Trumbull & Ryan, Boston, Mass.		19,479
William L. Miller,	" "	21,889
W. H. Ellis & Co.,	" "	22,000
J. N. Hayes & Co.,	" "	22,350
Benjamin Young,	" "	22,793
Pickering & Walker,	" "	22,900
Joseph Ross,	" "	29,240
Building a Steel Draw.		
Penn Bridge Co., Beaver Falls, Pa.		*$6,000
Boston Bridge Works, Boston, Mass.		6,584
Massillon Bridge Co., Massillon, O.		6,500
Wrought Iron Bridge Co., Canton, O.		7,000
Edgemoor Bridge Co., Wilmington, Del.		7,987
King Bridge Co., Boston, Mass.		8,490
R. F. Hawkins' Iron Works, Springfield, Mass.		9,420
Nine Draw Trucks.		
Geo. T. McLauthlin & Co., Boston, Mass.		**$775
Atlantic Works, Boston, Mass.		*1,674
Blanchard Machine Co., Boston, Mass.		1,690
Whittier Machine Co.,	" "	1,750
Miller & Shaw, Boston, Mass.		2,266

* Awarded contract.
** Withdrawn.

GREENFIELD, MASS.—It is reported that the selectmen have engaged A. H. Wright to secure specifications for a bridge at West Main St.

HUNTINGTON, MASS.—The selectmen have been authorized to prepare plans for a new iron bridge.

NEWTON, MASS.—The Boston Athletic Association is reported about to build a bridge over the Charles River to Riverside.

HAMDEN, CONN.—The selectmen have been authorized to rebuild the bridge over Lake Whitney.

DUNKIRK, N. Y.—The city clerk has been directed to advertise for new bids for building a bridge at Genet St. over Douglas Creek.

ITHACA, N. Y.—The construction of a bridge at Quarry St., estimated to cost $20,000, is being considered.

CAMDEN, N. J.—Bids are asked until June 12 for building a 36-ft. span iron bridge over Sweeten's Pond, Delaware township. S. M. Jaquillard, Chn. Com.

GLEN MOORE, N. J.—It is reported that the board of freeholders of Mercer county will soon ask for bids for constructing a 100-ft. span iron truss bridge, 22 ft. in width, at this place.

PLAINFIELD, N. J.—Wm. T. Kirk has been engaged by the freeholders of Union and Somerset counties to prepare plans for an iron bridge 24 ft. in width over Greenbrook at Clinton Ave.

DOYLESTOWN, PA.—Jesse McKinstry, R. H. Darah, and H. S. DeCoursey, viewers, have recommended the construction of a new bridge over Vanartsdalen Creek, in Warwick township.

MEDIA, PA.—Bids are asked until June 10 for constructing a brick arch stone bridge on the county line road over Naylor's Run, in Haverford township. Edward Blaine, Comr.

PITTSBURG, PA.—The Coraopolis, Sewickley & Economy Electric St. Ry. Co., recently incorporated, is reported about to build a bridge over the Ohio River from Neville Island to Hays Station at an estimated cost of $60,000. Pres., C. I. McDonald, of Pittsburg; Vice-Pres., Simon Harrold, of Beaver Falls; Secy., Geo. A. Laskell; Solicitor, W. T. Treadway, 110 Diamond St.

ELKTON, MD.—Bids are asked until June 12 for building six iron bridges in Cecil county. Manly Drennen, Clk. County Comrs.

SOUTH PARKERSBURG, W. VA.—The Little Kanawha Bridge Co. has been incorporated to build a bridge across the Little Kanawha River near Parkersburg; capital stock, $50,000, with $250 paid in; incorporators, J. H. Fischer and William Bently, of Parkersburg, and W. M. Kirk, David Lemley, and A. B. Chancellor, of South Parkersburg.

BUFORD, GA.—It is reported that the construction of a bridge between this place and Cumming is being considered.

BAINBRIDGE, O.—The commissioners of Geauga and Portage counties have voted to build a 75-ft. iron bridge in place of the present wooden one over the river near the county line.

CLEVELAND, O.—The council is considering the question of building a bridge over the railway tracks at Wiley St., on the West Side, at an estimated cost of $200,000, which includes the purchase of land.——The following bids were received May 29 for building the superstructure of Chagrin RRiver bridge: King Bridge Co., $19,600; Wrought Iron Bridge Co., $28,000; Massillon Bridge Co., $24,000; Daykin Bros., $32,000; New Columbus Bridge Co., $21,998; Canton Bridge Co., $22,950; Youngstown Bridge Co., $23,000; Toledo Bridge Co., $23,000; Keeper, Wynkoop & Thatcher, $22,900; Variety Iron Works, $20,495.

COLUMBUS, O.—Local papers state that Henry F. Guerin, receiver of the Clinton & Blendon Plank Road Co., has been authorized to issue certificates for $12,000, which are to be taken by the Columbus Central Ry., which will build one bridge across Alum Creek two miles south of Westerville.

PAINESVILLE, O.—Bids are asked until June 15 for the masonry for the substructure for a bridge over Tomlinson's Creek, according to reports. W. C. Tisdel, Audr. Lake county.

CRAWFORDSVILLE, IND.—J. D. Tracy, Cy. Clk., writes us that the Wrought Iron Bridge Co., of Canton, O., was awarded the contract for building a 66-ft. span bridge with a roadway 42 ft. in width, at $4,350. James M. Waugh, Cy. Engr.

LAFAYETTE, IND.—The Lafayette Bridge Co. has been incorporated with a capital stock of $2,000.

CHICAGO, ILL.—The board of west park commissioners has voted to permit the sanitary district to build two iron or steel bridges over the canal, the approaches to be 100 ft. wide.

PERU, ILL.—The council has voted to rebuild the double arch stone bridge over the ravine at an estimated cost of $12,000.

SPRINGFIELD, ILL.—The Springfield Bridge & Iron Co. has been incorporated, with a capital stock of $10,000; incorporators, Benjamin Ferguson, John McCreary and C. C. Brown.

HORICON, WIS.—It is reported that the county committee has condemned the long bridge at this place, and that it will be rebuilt at once.

MILWAUKEE, WIS.—The committee has recommended the building of a double-roadway steel bridge over the Milwaukee River from Huron St. to Clybourn St.

TOPEKA, KAN.—The King Bridge Co., of Kansas City, is reported to have prepared plans for a new bridge across the Kansas River at Kansas Ave.

CAPE GIRARDEAU, MO.—Bids are asked until June 29 for building a wooden bridge with stone piers over Cane Creek, on the Jackson and Millerville road. J. F. McLain, Bridge Com.

KANSAS CITY, MO.—Several steel bridges will be required on a 70-mile extension of the Kansas City, Pittsburg & Gulf R. R., the contract for which is noted under Railways.

HOUSTON, TEX.—Bids are asked until June 20 for building an iron bridge over Buffalo Bayou and one over Clear Creek. John G. Tod, County Judge.

RANGELY, COLO.—It is reported that bids will be asked as soon as the specifications and plans have been prepared for constructing a bridge over the White River at this place. H. A. Sumner, State Engr.

WINNIPEG, MAN.—The following bids have been received for constructing the superstructure of the Osborne St. bridge:

The Gillette-Herzog Mfg. Co., Minneapolis	$9,792
Hamilton Bridge Works, Hamilton, Ont.	9,880
Central Bridge & Engr. Co., Peterboro, Ont.	9,255
Dominion Bridge Co., Montreal	7,260
Hunter Bros., Kincardine, Ont.	10,300
King Bridge Co., Cleveland, O.	9,500
Chicago Bridge & Iron Co.,	9,000
Wisconsin Bridge & Iron Co.	9,970

BUILDINGS.

BOSTON, MASS.—Bids are asked until June 13 for the furnishing and erecting of all metal work for the Marblehead Light Tower, as stated in our advertising columns. William R. Livermore, U. S. Lighthouse Engr.

BROOKLYN, N. Y.—Arrangements are being made by the management of the Brooklyn Institute of Arts and Sciences for the early construction of its new building on the site of the Pierrepont Park reservoir. Archs., McKim, Mead & White, New York.

BUFFALO, N. Y.—Green & Wicks, Archs., have received the following bids for the construction of a six-story brick building of steel construction for George B. Mathews at No. 391 Main St.:

Henry Shafer & Sons, Buffalo	$81,242
John Feist, Buffalo	83,353
Collingwood & Donaldson, Buffalo	83,422
Charles Berrick & Sons, Buffalo	86,000
Joseph Metz, Buffalo	87,923
James Stewart & Co., St. Louis	89,022
George A. Fuller & Co., Chicago	100,630
J. Clark Sons Co., Chicago	112,013

NEW YORK, N. Y.—Bids are asked by the board of education until June 11 for altering the college buildings of the Normal College at 68th and 69th Sts.—It is reported that the New York School of Applied Design has stated that work will soon begin on the construction of a 10-story hotel on Seventh or Eighth Ave., between 23d and 42d St., estimated to cost $250,000. Archs., Mary N. Gannon and Alice J. Hands.

NEW YORK, N. Y.—Plans have been filed by Robert Hoe, 11 East 36th St., for a 10-story brick office building at 11 and 13 West 28th St., to cost $100,000; by Annie C. Doyle, 421 West 148th St., for a seven-story brick flat at St. Nicholas Ave. and 150th St., to cost $140,000; by C. H. Merriman, of Oakdale, N. Y., for a 10-story brick flat at 75th St. and Columbus Ave., to cost $275,000; by Mme. La Duchesse de Dino for a 16-story brick office building at 63 and 65 Wall St., to cost $225,000, and by Michael H. Gillespie, 1172 Fifth Ave., for a seven-story brick flat at Central Park West and 69th St., to cost $120,000.—Henry J. Hardenbergh, 10 West 23d St., has prepared plans for a 17-story hotel, 350×100 ft., at 34th St. and Fifth Ave. for William W. Astor.

ATLANTIC CITY, N. J.—The council has passed an ordinance appropriating $100,000 for building a new city hall.

GREENSBURG, PA.—The construction of a new court house for Westmoreland county is being considered.

WASHINGTON, D. C.—Bids are asked until June 20 for skylight framing, roof, steel vault lining, etc., for post office building. Wm. M. Aiken, Supervising Arch.

RALEIGH, N. C.—A correspondent writes us that the following cotton mills in North Carolina will make improvements by additions to buildings and equipment during the present summer: Mountain Island Mills, Mountain Island; Rutherfordton Mills, Pres., W. H. Norris, Rutherfordton; Randolph Mfg. Co., Franklinsville; Stirling Mills, Franklinton; new mill near Lincolnton, address, J. A. Abernathy, Lincolnton, N. C.

HAMILTON, O.—Bids are asked by the Niles Tool Wks. for constructing a new foundry building.

WOOSTER, O.—Bids are asked until June 15 for constructing a chemical laboratory for the Agricultural Experiment Station.

RICHMOND, IND.—We are informed that Louck & Hill, of Richmond, have been awarded the contract for building an addition to the Eastern Indiana Hospital for the Insane, at $45,000.

SOUTH BEND, IND.—The county commissioners have engaged A. W. Rush & Son, of Grand Rapids, Mich., to prepare plans for a new $300,000-court house, according to reports.

DETROIT, MICH.—Bids are asked until June 10 for erecting an iron tower at Calumet Pierhead, Ill., as advertised in our issue of last week. Maj. M. B. Adams, U. S. Engr. Office.

CHICAGO, ILL.—Bids are asked until June 8 for erecting a temporary brick postoffice building, 500×250 ft., estimated to cost $175,000. Address Wm. Martin Aiken, Supervising Arch., Washington, D. C.

MILWAUKEE, WIS.—A new store is to be erected by William Plankinton on Grand Ave., at an estimated cost of about $250,000.

FARIBAULT, MINN.—Bids are asked until June 28 for erecting a custodian building on the grounds of the state school for feeble minded. Arch., W. B. Dunnell, Minneapolis; J. R. Parshall, Faribault.

ATCHISON, KAN.—Bids are asked until June 15 for remodeling or building a new theatre. Arch., W. A. Powell, St. Joseph, Mo.; address, John Seaton.

WATER-WORKS.

MECHANIC FALLS, ME.—The Poland & Minot Water, Power & Electric Light Co. has been reorganized as the Mechanic Falls Water Co., and a contract has been signed with the town committee whereby the company will construct works. About 6¼ miles of pipe, a stand-pipe and 35 hydrants will be required. Wm. H. Hayden, of Bath, will superintend the construction. Pres., Chas. H. Mason; Secy., F. R. Mason.

PORTSMOUTH, N. H.—The Frank Jones Brewing Co. has been granted permission to lay water pipes from the Lane farm in Newington to its brewery.

SOMERSWORTH, N. H.—The water committee has reported in favor of municipal works, and it is expected that the council will take immediate steps to secure a new system.

WEST RUTLAND, VT.—The committee is investigating a source of supply. M. Odell, Chn.; J. E. Burke, Clk. Com.

BOSTON, MASS.—Bids are asked by the Boston water board until June 10 for laying flexible jointed water pipe in Boston harbor, 7,500 ft. of 6-in. and 2,400 ft. of 4-in. pipe.—The following bids were received May 31 for laying about 7,800 ft. of 48-in. pipe in Brookline: Stephen Connelly, Boston, $18,675; D. F. O'Connell, Boston, $21,291; Thomas F. Maney, Quincy, $22,944; T. J. Kelley, Brookline, $23,630; H. P. Nawn, Boston, $23,900; F. A. Snow, Brookline, $25,245; W. T. & R. A. Davis, Boston, $28,138; F. E. Hall & W. W. Ewell, Quincy, $34,525; Weaving, Booth & Parry, Boston, $34,560.

QUINCY, MASS.—The council has voted to appropriate $250 for investigating the cost of storing the waters of the Blue Hill River.

ALBANY, N. Y.—It is stated that bids will soon be asked for the foundation for the new pumping engine.

BROOKLYN, N. Y.—The Flatbush Water-Works Co. has offered to reduce the rates to consumers 25%, provided the number of fire hydrants is increased by 300, at $35 per year each, and that a contract be made for five years.

FREDONIA, N. Y.—The village trustees have voted in favor of building a second reservoir, to cost not over $20,000, which amount the legislature recently authorized the village to spend for enlarging the works. C. A. Clute, Clk.; E. A. Wilder, Engr.

HEMPSTEAD, N. Y.—This village has voted, 105 to 4, to issue $46,500 in bonds for works.

HOMER, N. Y.—The present contract for a village water supply expires in July, and efforts are being made to secure municipal works.

JEFFERSONVILLE, N. Y.—It is reported that the town board has been petitioned for a franchise for works.

LEROY, N. Y.—E. D. Smalley, of Syracuse, has been investigating the question of works, and has recommended that 72 additional hydrants be put in. The village now has 23 hydrants. The proposed improvements are estimated to cost $35,000.

MONTICELLO, N. Y.—Bids are asked until June 19 for the construction of works, including about 22,000 ft. of 8 to 4-in. pipe, pump, etc., as stated in our advertising columns. Consult. Engr., John A. Miller, Goshen, N. Y.; D. S. Avery, Pres. Comrs.

NAPLES, N. Y.—Voorhees & Witmer, of Buffalo, have been engaged to prepare plans for works, estimated to cost $15,000 to $18,000.

NIAGARA FALLS, N. Y.—The Niagara Falls Water-Works Co. has contracted with the Morison-Jewell Filtration Co. for a 4,500,000-gallon filter plant. The improvements will cost about $50,000.

NYACK, N. Y.—The Nyack Water-Works Co. is reported as considering the securing of a supply from driven wells. The present supply is from Hackensack Creek.

PAINTED POST, N. Y.—An election will be held June 10 to vote on an issue of $20,000 in bonds for works. Engr., W. F. Randall, Syracuse.

SYRACUSE, N. Y.—Local papers state that the following bids were received May 31 for pipelaying, as advertised in Engineering News:

	Southeast section.	Southwest section.
P. J. Brumelkamp & T. Lane, Syracu.	$34,223	.....
Jas. Kinney & Matt. Dillon, Syracuse.	35,827	$50,019
John Dunfee, Syracuse	35,878	38,723
A. F. Nims, Elkhart, Ind.	36,237	.....
Edward S. Candee, Syracuse	37,062	.....
John Kelley, Syracuse	38,458	42,123
Thomas K. Marnell, Syracuse	39,456	.....
W. D. Dodge & J. MacGregor, Buffalo.	40,882	41,755
George D. Grannis, Syracuse	41,149	44,644

WEST TROY, N. Y.—The following bids were received May 24 for the construction of an independent water supply system for the Watervliet arsenal; the items calling for the following work: 1, Construction of water tower; 2, interior equipment of water tower complete with filtering tank; 3, water tank; 4, laying 5-in. cast iron force pipe; 5, laying 5-in. distribution pipe: Oscar F. Hilt, 1, $5,645; 2, $3,510; 3, $1,519; 4, $1,437; 5, $900. William H. Barnes, 2, $3,224; 4, $1,475; 5, $774. James H. Brennan, 1, $5,630. John P. Kelly, 1, $6,800; 1 and 2, $10,350; 1, 2 and 4, $12,100; 1, 2, 4 and 5, $12,900. James Dollard, 1, $5,700. Chester J. Ives, 1, $6,245; 2, $3,500; 3, $1,550; 4, $1,475; 5, $774. Franklin Iron Works, 3, $1,550. McGowan & Boland, 1, $5,592.

WHITE PLAINS, N. Y.—The committee is reported to have engaged Mr. Fritchman to prepare plans for new works, and also to report on a proposed supply from driven wells.

JERSEY CITY, N. J.—Bids are asked by the street and water commissioners until July 1 for gravity water supply of 20,000,000 to 50,000,000 gallons daily.

ALLEGHENY, PA.—Bids are asked until June 13 for the construction of an engine house, boiler house, etc., at Montrose Station, for the new water-supply. Robt. McAfee, Dir. Pub. Wks.

JENKINTOWN, PA.—A petition is being circulated asking the council to take steps to secure new works.

McKEESPORT, PA.—The committee has contracted with the Wilson-Snyder Co. to repair the pump at the main pumping station, at a cost of $6,175.

MEADVILLE, PA.—The council has voted to accept the offer of the Meadville Water Co., noted last week. The company will sell its plant for $105,000, and will reimburse Chandley Bros., contractors for the new works, for their trouble and expense.

PERKASIE, PA.—A. P. Folwell, Engr., of Philadelphia, writes us that the contract for works, as advertised in Engineering News, has been awarded to P. H. Harrison & Sons. The bids are published under Contract Prices.

POTTSTOWN, PA.—The Pottstown Passenger Railway Co., owner of Sanatoga Park, is reported about to erect a complete water-works plant at the park.

WASHINGTON, PA.—The contract for constructing the dam for the new reservoir has been awarded to R. T. Hallam & Sons, of Washington, at $12,000. J. Mac. Jones, Supt.

WOMELSDORF, PA.—The Womelsdorf Water Co. was incorporated May 29, with a capital stock of $1,000. Treas., Dr. E. H. Leffler, Millersburg, Pa.

BENWOOD, W. VA.—The Benwood Water-Works Co. is negotiating with the council for the construction of works. It is proposed to secure the water supply from the city of Wheeling.

RUTHERFORDTON, N. C.—It is reported that about $1,000 will be expended for a water supply.

STATESBORO, GA.—Bids are asked for the sinking of an artesian well in this town. J. G. Blitch.

SANDERSVILLE, GA.—An election will be held July 15 to vote on an issue of $15,000 of 5% 30-year bonds for works and an electric light plant.

WEST POINT, MISS.—It is reported that works will be put in soon. Engrs., Bell & Yates.

CELINA, O.—Bids are asked until June 13 for air lift machinery, including air compressor, receiver, piping, etc., as stated in our advertising columns. Engrs., Voorhees & Witmer, Buffalo, N. Y.; J. P. Le Blond, Pres. Trustees.

LOGAN, O.—The council has engaged Frank Snyder, of Columbus, to prepare plans for works.

WAPAKONETA, O.—Bids are asked until June 25 for the construction of works, including pumphouse and receiving well, pumping machinery, pipe, hydrants, valves, water tower, etc., as stated in our advertising columns. Consult. Engr., Geo. Hornung, Cincinnati; Henry Moser, Pres. Trustees.

YOUNGSTOWN, O.—The water-works trustees have requested that an election be held to vote on an issue of $186,000 in water bonds.

BATTLE CREEK, MICH.—The council has voted to hold a special election to submit the question of issuing $30,000 in bonds for extensions of the water mains to the voters.

BLOOMINGTON, ILL.—The council has voted to construct a dam for a new reservoir, which will cover five or six acres.

CHICAGO, ILL.—The mayor, city engineer, and others inspected the 68th St. crib last week, and reported that it would have to be rebuilt at once, at a cost of about $200,000. Several other improvements are being considered.

ELMWOOD, ILL.—Z. L. Gilbert, Cy. Clk., writes us that the contract for an artesian well has been awarded to W. H. Gray & Bros., of Chicago, at $3,435.

FOREST HILL, ILL.—At an election June 3 the question of constructing works to cost about $6,000 was voted upon.

GREENFIELD, ILL.—Hiram Phillips, of St. Louis, has been engaged to prepare plans and specifications for works, to cost about $20,000.

OCONOMOWOC, WIS.—The council has voted to secure surveys for municipal works.

WATERTOWN, WIS.—W. H. Wheeler & Co., of Beloit, Wis., have made a proposition for constructing works, which, it is stated, would include about 15 miles of mains and 140 hydrants.

WHITEHALL, WIS.—C. P. Thompson, Village Clk., writes us that the following bids were received May 31 for the construction of a water-works system: Fairbanks, Morse & Co., St. Paul, Minn., $7,400; Fairbanks, Morse & Co., second proposition, $5,815; Albert V. Fetter, La Crosse, Wis., $7,300; Jas. H. Fife, Oshkosh, Wis., $7,236; Jas. H. Fife, second proposition, $6,325; Jas. H. Fife, third proposition, $6,350; Jas. H. Fife, fourth proposition, $6,686; Foley & Connelley, Menominee, Mich., $6,427; Foley & Connelley, second proposition, $5,627. The contract was awarded to the last-named parties. Second proposition was for steam pump in place of gasoline engine.

REDFORD, IA.—The town is reported about to vote on an issue of $15,000 in bonds for works.

KEOSAUQUA, IA.—This city is reported as investigating the question of works, the supply to be from the Des Moines River.

ROCK VALLEY, IA.—W. H. Wheeler & Co., of Beloit, Wis., have petitioned for a franchise at this place, according to press reports.

ROCKWELL CITY, IA.—At a special election May 28 the citizens voted to issue bonds for works.

AMBOY, MINN.—Bids are asked until June 10 for the construction of works, for which bonds were recently voted, as noted in our issue of last week. Plans are on file at the office of Fairbanks, Morse & Co., in St. Paul. L. E. Cross, Village Recdr.

EVELETH, MINN.—H. L. Darms, Village Pres., writes us that this village will soon construct works, to cost $5,000, consisting of a well, pumping station, two pumps, 2,100 ft. of 6-in. mains, and 5 hydrants. An elevated tank will probably be added in a few months. The village is about 8 months old and has a population of 1,200, with good prospects of 3,000 by next fall.

FRANKLIN, MINN.—At an election May 31 the citizens voted to issue $4,000 in bonds for works.

KENYON, MINN.—A contract for 6,500 ft. of extensions has been awarded to Fairbanks, Morse & Co., of St. Paul.

NEW PRAGUE, MINN.—The council is reported to have decided to put in works.

PINE ISLAND, MINN.—It is reported that works will be put in this summer and nearly $100,000 expended in improvements.

ST. CHARLES, MINN.—Bids are asked until June 10 for the construction of works, as noted in our issue of May 16. N. D. Gould, Cy. Recdr.

ST. PAUL, MINN.—Bids are asked until June 12 for furnishing and erecting a 5,000,000-gallon pumping plant at Vadnais Lake. John Caulfield, Secy. Comrs.

ST. PETER, MINN.—The water committee is investigating the question of proposed extensions.

HASTINGS, NEB.—Bids will soon be asked for sinking a new well, according to reports.

NEWTON, KAN.—The citizens have voted, 565 to 60, to issue $80,000 in bonds, including $75,000 for the purchase of works and $5,000 for improving the plant.

HURON, S. DAK.—John H. Miller, of Huron, has been appointed receiver of the Huron Water-Works Co.

TEXARKANA, ARK.—The Water Company of Texarkana was incorporated in New Jersey June 3, with a capital stock of $125,000, with $1,000 paid in: Incorporators, Wm. M. Paul, Moorestown, N. J.; Edward Lewis, 33d St. and Powelton Ave., Philadelphia, and George M. Noble, of Topeka, Kan. Works were built in this city in 1887 by the Texarkana Water Co. under a 30-year franchise.

BRENHAM, TEX.—J. S. Rice, of Rusk, has been awarded a contract for furnishing water pipe for extending the mains.

PORTLAND, ORE.—Bids are asked until June 18 for the purchase of $200,000 in 5% 30-year water bonds. Frank T. Dodge, Clk. Com.

TUCSON, ARIZ.—The council has appointed a committee to contract for a new water supply.

TORONTO, ONT.—The board of works has adopted the report of the city engineer regarding works on the island. The system will supply from 4,000 to 5,000 people, and will cost $15,000. It is expected that the construction will be commenced at once.

IRRIGATION.

ORD, NEB.—H. E. Babcock has petitioned for permission to construct an irrigation ditch 30 miles in length, the water to be taken from the Calamus, between Burwell and Fullerton.

PHOENIX, ARIZ.—The California Powder Works, of San Francisco, is reported to have been awarded the contract for 1,400,000 lbs. of explosives by the Minnesota & Arizona Construction Co., to be used in the building of the Horseshoe reservoir dam, the diversion dam and the 98 miles of the canal of the Rio Verde Canal Co. It is estimated that the rock work on these three pieces of work will amount to about 700,000 cu. yds. Consult. Engr., Donald W. Campbell. The construction company is composed of Langdon, Linton & Co., of Minneapolis, and Donald Grant & Co., of Faribault, Minn.

NEW COMPANIES.—Tyndall Irrigation Co., Chicago, Ill.; $40,000; William Fitzgerald, H. A. Bassett, John Powers.

Hubatt & Hall Irrigation & Land Co., North Platt, Neb.; $6,000, with $1,200 paid in; A. B. Hall, E. Hubatt.

Platte River Irrigation Co., Omaha, Neb.; $150,000, with $5,000 paid in; Isaac N. Watson, Herbert H. Neale, Fred G. Watson.

San Diego Flume Co., San Diego, Cal.; $1,000,000, with $452,000 paid in; to build dams and irrigating ditches, the water to be taken from the San Diego River; Geo. D. Copeland, T. S. Van Dyke, R. H. Stretch, San Diego; Milton Santee, Los Angeles, Cal.

SEWERAGE.

BRUNSWICK, ME.—The town has voted to issue $30,000 of 4% bonds for building sewers. Engr., Ernest W. Bowditch, of Boston.

LAWRENCE, MASS.—The committee has been directed to award the contract for beginning the construction of a system in South Lawrence to abate the Shanty Pond nuisance. The first section of the work will cost about $45,000.

MERIDEN, CONN.—It is proposed to build two new sewage disposal beds, and also to improve the old ones.

NEW HAVEN, CONN.—The committee has recommended that sewers be constructed in two streets.——The council has been petitioned to build sewers in two other streets.

ROCKVILLE, CONN.—The council has voted to call a city meeting June 8 to vote on an issue of $150,000 in 30-year 4% bonds for sewers.

BROOKLYN, N. Y.—Bids are asked until June 11 for constructing an outlet sewer in Washington Ave. A. T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—Bids are asked until June 13 for constructing 18 to 10-in. pipe sewers in two streets. R. G. Parsons, Secy. Dept. Pub. Wks.

CANANDAIGUA, N. Y.—It is proposed to construct a sewer in two streets. M. T. Powell, Attorney Bd. Trustees.

CLINTON, N. Y.—Bids are asked until June 17 for the construction of 26,000 ft. of pipe sewers, as stated in our advertising columns. Engr., A. M. Scripture, New Hartford, N. Y.; E. B. Stanley, Clk.

DUNKIRK, N. Y.—It is proposed to construct a 15-in. outlet sewer in Pangolin St.——The city attorney has been directed to prepare a resolution authorizing the construction of a system.

JAMESTOWN, N. Y.—The city clerk is reported to have been directed to advertise for bids for a supply of sewer pipe.

OSWEGO, N. Y.—It is proposed to construct 10-in. pipe sewers in two streets. F. D. Wheeler, Cy. Clk.

PELHAM MANOR, N. Y.—Bids are asked until June 17 for constructing a sewer system in this village, as stated in our advertising columns. Address F. Charles Merry, Pres. Comrs., 13 Astor Place, New York.

ROCHESTER, N. Y.—Bids are asked until June 17 for constructing a sewer in two streets. T. J. Neville, Clk.——The following bids have been received for constructing an outlet sewer in Mount Vernon Ave. and Meigs St.: estimated cost, $17,500: Bruff & Stewart, $12,891; Chambers & Casey, $15,040; William Fuller, $16,335; Lauer & Hagaman, $16,581; Brayer & Albaugh, $21,645.

SYRACUSE, N. Y.—Bids are asked until June 10 for constructing a 32 and 30-in. brick sewer in the Marsh Road. H. F. Stephens, Cy. Clk.

TROY, N. Y.—Bids are asked until June 11 for constructing 12-in. pipe sewers in three streets. E. O. Ross, Secy. Bd. of Contract.

HACKENSACK, N. J.—The council of Bogota has voted to construct a sewer in two streets. R. C. Lydecker, Borough Clk.

HOBOKEN, N. J.—It is proposed to construct a brick sewer in Jackson St. M. V. McDermott, Cy. Clk.

NEWARK, N. J.—The commissioners have passed ordinances for constructing pipe sewers in 23 streets, and a brick sewer in three streets. A. M. Linnett, Clk. Comrs.

PATERSON, N. J.—The reconstruction of the North West St. sewer is being considered.——The committee has voted to construct a sewer in Market St.

PHILADELPHIA, PA.—The residents of Mount Airy are considering the question of improving and extending the sewers and paving portions of two streets. The Permanent Improvement Association has been organized to urge the improvements. Geo. J. Lincoln, Chn.——The board of surveyors has recommended the construction of sewers in 14 streets.

WILMINGTON, DEL.—The city engineer has been directed to prepare estimates for sewers in three streets.

WASHINGTON, D. C.—Plans have been prepared for a temporary outlet sewer at East Capitol St. and Anacostia River, to aid in reclaiming the Anacostia flats.

BIRMINGHAM, ALA.—The city engineer has prepared plans for a proposed sewer in the south side, estimated to cost $110,000.

AUGUSTA, GA.—Bids are asked until June 8 for constructing the Crawfish ditch sewer. A. H. Davidson, Cy. Engr.

TOLEDO, O.—Bids are asked until June 10 for constructing a 24-in. brick sewer in Kimball Ave. L. P. Harris, Cy. Clk.

INDIANAPOLIS, IND.—Bids are asked until June 11 for constructing about 7,000 ft. of 18 to 8-in. pipe sewers and until June 13 for constructing 706 ft. of 36 × 20-in. brick and about 4,500 ft. of 18 to 10-in. pipe sewers. C. C. Brown, Cy. Engr.

ANN ARBOR, MICH.—Geo. F. Key, Cy. Engr., writes us that the following bids were received for constructing sewers, as a result of advertising in Engineering News:

	Districts	
	No. 3.	No. 4
Schneider & Boss	$34,973	$5,434
William McMahon	34,656	5,420
Clarken & Clancey	41,690	6,292
Muir & O'Sullivan	40,474	5,952
Branham & Gest	51,119	7,693
M. C. Sloan & Co.	34,195	6,298
Geo. S. Miller & Co.	29,420	4,991
Berk, Reid, Finane & Shultz	27,945	4,931
Peterson & Co.	28,867	5,384
Greenville Construction Co.	39,790	7,500
Walker & Robinson	38,500	6,000
Jenkenson & Nicholson	37,000	5,100
J. C. Danforth	29,875	4,975
Ulrich, Nissley & Williams	38,500	6,000
John Wagner	55,700	6,900
George B. Kelley	36,990	5,550
Mercier & Affeldt	32,874	4,797
South Bend Construction Co.	31,400	4,900
Elphardt & Winterhalter	28,900	4,250
Campbell & Dennis	37,582	5,316
Grimes & Moran	46,841	7,995
W. W. Cook	29,285	4,810
Henry Collins	26,747	4,181
D. A. McLeod	73,456	....
Thomas P. Sheehan	Informal.	Informal.
Thomas F. Moore	Informal.	Informal.

BATTLE CREEK, MICH.—It is reported that the council has voted to issue $10,000 in bonds for sewer extensions

GRAND RAPIDS, MICH.—Plans have been prepared for a trunk sewer and a sewage pumping station on the West Side, estimated to cost $220,000, or without the pumping station, $135,625.

MAYWOOD, ILL.—Bids are asked until June 14 for constructing 10,160 ft. of 18 and 10-in. pipe and 1,350 ft. of 24-in. brick sewers. Engrs., Hill & Enright, Chamber of Commerce, Chicago; S. H. Donaldson, Jr., Village Clk.

GRINNELL, IA.—The committee is considering estimates for sewers, which will soon be constructed, according to reports.

MASON CITY, IA.—The extension of the system in Willow Creek at an estimated cost of about $100,000 is being considered.

ROCHESTER, MINN.—The council has voted to advertise for bids for constructing 6,000 ft. of 15 to 10-in. pipe sewers.

TWO HARBORS, MINN.—C. P. Frank, of Duluth, is reported to have been engaged to prepare plans for a system, estimated to cost $30,000.

ST. JOSEPH, MO.—The city engineer has been directed to advertise for bids for constructing sewers in two streets. C. S. Shepherd, Cy. Clk.

GARBAGE DISPOSAL.

BRIDGEPORT, CONN.—The Bridgeport Utilization Co. has been granted an extension of time until Aug. 15 for the completion of its plant. The company was recently granted a contract to take and dispose of all garbage, dead animals, etc., for 10 years, at 34 cts. per ton of 2,000 lbs. It is stated that no site has yet been decided upon for the plant.

NEW YORK, N. Y.—The disinfecting plant at Riker's Island will be sold at public auction June 18, as noted in our advertising columns. Geo. E. Waring, Jr., Comr. of St. Cleaning.

HOBOKEN, N. J.—The contract for garbage collection has been awarded to Antonio Padveano. The bids were published last week.

SAN ANTONIO, TEX.—The lowest bid received for the removal of garbage was that of J. M. Carr, at $6,975 for one year or $13,500 for two years. Bids for the removal of dead animals were to have been opened June 3, no bid to be considered that involved an expense to the city.

OAKLAND, CAL.—Dr. J. L. Mayon, Health Officer, is quoted as stating that the most urgent need of the city at present is a garbage crematory.

STREETS AND ROADS.

BRISTOL, ME.—Bids are asked until July 1 for building 5,643 lin. ft. of road in Walpole and South Bristol. H. H. Goudy, W. C. Thompson, and A. A. Farrow, Selectmen.

BOSTON, MASS.—Plans have been prepared and submitted to the Citizens' Improvement Association by the residents of Brighton for a boulevard, 60 to 100 ft. in width, from Oak Square to Commonwealth Ave.

MILLBURY, MASS.—Thomas Hill is reported to have been awarded the contract for building a mile of road for the Worcester Hunting Club.

TEWKSBURY, MASS.—Bids are asked by the selectmen until June 8 for constructing a new road in North Tewksbury.

WALTHAM, MASS.—The aldermen have voted to issue $80,000 of 4% bonds for constructing a section of the Commonwealth Boulevard, between Washington St., West Newton, and Auburn St., Auburndale.

WATERTOWN, MASS.—The question of rebuilding about a mile of Main St., at an estimated cost of about $10,000, is being considered.

PROVIDENCE, R. I.—The commissioners are considering the question of macadamizing Benefit St.

MIDDLETOWN, CONN.—The repaving of Main St. with brick, at an estimated cost of about $45,000, is being discussed.

BROOKLYN, N. Y.—Bids are asked until June 17 for flagging portions of 33 streets. A. T. White, Comr. Cy. Wks.

GLOVERSVILLE, N. Y.—Bids are asked until June 10 for 5,550 sq. yds. of brick paving. E. B. Baker, Cy. Engr.; F. H. Wilmarth, Cy. Clk.

JAMESTOWN, N. Y.—It is reported that Fourth St. will be paved. Geo. W. Jones, Cy. Engr.

NEW YORK, N. Y.—Edward P. North, Water Purveyor, has recommended the paving of 195,025 sq. yds. with asphalt, at an estimated cost of $780,000.

OSWEGO, N. Y.—The council has voted to macadamize West Fifth St., and it is proposed to improve a number of other streets.

ROCHESTER, N. Y.—The city surveyor is preparing to repave a portion of Mount Hope Ave. with Medina sandstone, at an estimated cost of $10,000.

SYRACUSE, N. Y.—Bids are asked until June 10 for grading and improving portions of two streets. H. F. Stephens, Cy. Clk.

TROY, N. Y.—Bids are asked by the contracting board until June 11 for paving Pawling Ave. with brick at an estimated cost of $60,000.

BAYONNE, N. J.—It is proposed to pave West 22d St. with Shark River gravel on a 6-in. trap rock foundation.

BELLEVILLE, N. J.—Bids are asked until June 11 for the purchase of $65,000 of 4% macadam improvement bonds. H. W. Underwood, Chn. Township Com.

MORRISTOWN, N. J.—Bids are asked until June 15 for grading and macadamizing 26 roads, about 5½ miles, as stated in our advertising columns. Merritt B. Lum, Dir. Bd. Freeholders, Chatham; Wm. E. King, County Engr., Landing.

NEWARK, N. J.—The commissioners have passed ordinances for grading and paving several streets with granite blocks, asphalt, etc.——Thomas A. O'Connor has been awarded the contract for paving St. Francis St. with granite, on concrete foundation, at $13,808, and the Barber Asphalt Paving Co. that for paving Chestnut St., at $6,591.

LATROBE, PA.—Bids are asked until June 10 for grading and paving Main St. S. A. Pelghtal, Secy.

PITTSBURG, PA.—The council of East Washington is about to pave East Bean St., at an estimated cost of $18,000, and to improve Wade Ave., at a cost of $5,000.

LOCK HAVEN, PA.—The paving of several streets is being discussed by the council.

WILMINGTON, DEL.—The secretary of the street and sewer department has been directed to advertise for bids for grading three streets, and for furnishing blocks for paving two streets.

WASHINGTON, D. C.—Bids are asked by the district commissioners until June 14 for constructing cement sidewalks.

RALEIGH, N. C.—We are informed that the newly-elected board of aldermen was chosen on the issue of extensive street improvements. Considerable curbing and other work will be done during the summer. No bids have yet been asked. H. C. Smith, Cy. Clk.; W. Z. Blake, St. Comr.

CINCINNATI, O.—Bids are asked until June 22 for improving Hanley Road, Colerain township. G. C. Zimmerman, Clk. Comrs. Hamilton County.

CINCINNATI, O.—Bids are asked until June 17 for paving portions of four streets with brick and one with cobblestones. A. P. Butterfield, Clk. Bd. Administration.

PIQUA, O.—Bids are asked until June 24 for paving portions of five streets with granite, brick, or asphalt. H. E. Whitlock, Cy. Engr.; Seth McCulloch, Cy. Clk.

INDIANAPOLIS, IND.—Bids are asked until June 11 for 500 sq. yds. of brick paving and 1,200 lin. ft. of gravel street.——Resolutions have been adopted for 800 lin. ft. of brick and 800 lin. ft. of cement sidewalks, and 5,500 lin. ft. of asphalt paving, the contracts to be awarded about July 1. C. C. Brown, Cy. Engr.

JONESBORO, IND.—It is reported that Joseph Derheimer, of Fort Wayne, has been awarded a $70,000 contract for brick paving at this place.

MICHIGAN CITY, IND.—Bids are asked until June 10 for paving Franklin St. with brick, according to reports. A. H. Leist, Cy. Clk.

RICHMOND, IND.—The council is considering the question of paving North E. St. H. L. Weber, Cy. Engr.

JACKSON, MICH.—The council has voted to pave portions of five streets, at an estimated cost of $77,800, the work to be begun at once.

SAGINAW, MICH.—The council has decided to pave Genesee Ave. with asphalt.

SANILAC CENTER, MICH.—The people of Sanilac county, between this place and Carsonville, are reported as considering the question of rebuilding a road eight miles in length.

ISHPEMING, MICH.—The question of paving the business streets is being considered.

SAGINAW, MICH.—The paving of Gratiot St. with brick or cedar blocks is being discussed.

BLOOMINGTON, ILL.—The citizens have voted to pave 1,216 ft. with brick.

SPRINGFIELD, ILL.—Contracts will soon be awarded for about 60,000 sq. yds. of brick paving, according to reports. C. M. Rickard, Cy. Engr.

GALESVILLE, WIS.—It is reported that a large amount of macadamizing and improving of public grounds is to be done this summer.

JANESVILLE, WIS.—Surveys have been made for a boulevard in the third ward.

STEVENS POINT, WIS.—Bids are asked until June 10 for 8,000 sq. yds. of cedar block paving and about 2,500 lin. ft. of stone curbing. J. E. Rogers, Cy. Clk.

OMAHA, NEB.—Bids are asked until June 26 for constructing macadam roads at Fort Crook. Maj. Chas. F. Humphrey, Office Constructing Quartermaster.

HAMILTON, ONT.—The city engineer has been directed to report on the question of asphalt and brick paving and macadam roads.

WINNIPEG, MAN.—The board of works has been petitioned to macadamize two streets.

CONTRACT PRICES.

BRICK PAVING.—Frankfort, Ind.—Alonzo. J. Hammond, Cy. Engr., informs us that the contract for 22,000 sq. yds. of paving with one course of brick or block on 8 ins. of broken stone concrete foundation, with 6,300 ft. of 5×24-in. curbing, as advertised in Engineering News, has been awarded to the Capitol Paving & Construction Co., at $37,071 for Poston block paving and stratified curbing. The bids were as follows:

Bids Received at Frankfort, Ind., May 21, for Brick Paving.

Bidder.	Brick, per sq. yd.						Curbing, per lin. ft.	
	Wabash Clay Co. Poston block.	Clinton P. & B. Co. rep. brick.	Galesburg Paving Brick Co. brick.	Royal & Imperial Slate Co., Canton, Ohio.	Harris paver.	Harris Standard.	Oolitic.	Stratified.
Scott & McDowell, Kokomo, Ind.	$1.69	.....	.....	.....	.....	.....	$0.51	.....
Fries, Barr & Co., Greenfield, Ind.	1.78	$1.69	.....	.....	$1.69	$1.69	.46	$0.515
Geo. S. Miller & Co., Ottawa, Ill.	1.57	1.49	.....	.....	1.53	1.58	.55	.55
Jenkins, Brown & Co., Frankfort, Ind.	1.70	1.62	.....	.....	1.66	1.71	.58	.58
C. M. Kirkpatrick, Greenfield, Ind.	1.65	1.55	.....	.....	1.62	.....	.60	.60
Ross & Hedgcock, Frankfort, Ind.	1.85	1.75	.....	.....	.....	.....	.60	.60
Voorhees, Kniser & Grunts, Terre Haute, Ind.	1.87	1.87	.....	$2.00	1.89	.....	.65	.65
M. L. Bowlin, Tipton, Ind.	1.65	1.46	.....	1.695	1.505	1.56	.52	.52
Brawder & Shover, Indianapolis, Ind.	1.60	1.52	.....	.....	1.58	1.61	.645	.645
Gantz & Sullivan, Columbus, Ohio	1.65	1.50	.....	.....	1.54	1.59	.52	.52
Capitol Paving & Const'n Co., Indianapolis, Ind.	1.49	.....	.....	.....	.....	.....	.58	.58
J. W. Wilding & Co., Indianapolis, Ind.	1.53	1.54	$1.60	1.69	1.54	1.60	.54	.57
A. G. Pugh & Co., Columbus, Ohio.	1.78	1.68	1.87	1.79	1.72	.....	.73	.79
Derheimer, Brandon Co., Fort Wayne, Ind.	1.62	1.55	.....	1.65	1.58	1.64	.57	.57
Williard Morris, Frankfort, Ind.	2.43	.....	.....	.....	.....	.....	.87	.87
Talbot Paving Co., Detroit, Mich.	1.68	1.58	.....	.....	1.61	.....	.62	.66
Watkins & Dalton, Anderson, Ind.	1.74	1.55	.....	.....	1.69	.....	.56	.56
Indiana Paving Brick Co., Indianapolis, Ind., bid	1.72	to $1.75 on Brazil brick			.....	.....	.65	.68

SEWERS.—Harlem (P. O., Oak Park), Ill.—We are informed that the following bids were received May 25 for constructing sewers, as noted in our issue of May 16; Seckner Contracting Co. submitting a lump bid only; Engr., Robt. E. Williams, 712 Oxford Bldg., Chicago:

Bids Received at Harlem, Ill., May 25, for Constructing Sewers.

Quantities.		M. Donahue.	D. Hardin.	W. F. Reichert & Co.	T. Rowan.	F. W. Kinser & Son.	Farley & Green.	Campbell & Dennis.	Henry Rons.	H. D. Hallett.	F. L. Reeves, Magnes & Co.	J. P. Schanahan.	Jas. Murphy.	Nelson & Cleary.**	John Healy.	Kisgack & Muir.	Nash & Howdle.	B. Williams.	A. Maloney.	J. Healey & Son.	T. & P. Burke.	G. B. Kelley.	M. J. Healy.	Kelly & Musteeman.	C. W. Maynard.	P. J. McNulty.	C. M. Porter.	H. Troost.*
30-in.	340 ft.	$2.10	$2.26	$3.10	$2.05	$3.15	$3.35	$2.70	$2.25	$2.90	$2.95	$2.25	$2.15	$1.96	$1.695	$3.16	$2.89	$2.50	$2.21	$2.44	$1.90	$1.95	$1.75	$1.20	$2.10	$1.75	$2.69	$2.25
27-in.	331 "	1.45	1.97	3.10	1.85	2.14	3.00	2.60	2.15	2.70	2.50	1.80	2.15	1.90	1.695	2.46	2.65	2.10	1.82	1.87	1.60	1.65	1.28	1.15	1.97	1.35	2.43	2.00
24-in.	331 "	1.15	1.76	3.10	1.35	1.85	2.50	2.10	2.00	2.15	1.70	1.45	2.00	1.24	1.695	1.83	2.25	1.60	1.46	1.65	1.25	1.30	1.18	1.00	1.33	1.25	1.81	1.60
15-in.	318 "	.80	.99	1.00	.90	.89	.90	1.50	.90	1.00	1.00	.94	1.00	.71	1.10	1.04	1.15	.90	.97	.97	.83	1.00	.75	.77	1.05	.80	.95	1.05
12-in.	2,530 "	.70	.84	1.00	.65	.69	.80	.97	.85	.75	.83	.82	.77	.58	.695	.895	.89	.79	.79	.97	.61	.67	.58	.63	.64	.62	.76	.90
12-in.	2,530 "	.70	.84	1.00	.65	.69	.80	.95	.85	.75	.80	.82	.77	.57	.695	.895	.89	.79	.75	.97	.61	.66	.58	.63	.64	.62	.74	.90
12-in.	2,530 "	.70	.81	1.00	.65	.69	.80	.90	.82	.72	.73	.82	.77	.55	.695	.82	.89	.79	.74	.97	.61	.65	.58	.63	.64	.62	.74	.90
12-in.	2,530 "	.70	.765	1.00	.70	.69	.80	.80	.85	.70	.73	.82	.77	.55	.695	.795	.89	.79	.69	.61	.61	.65	.58	.63	.64	.62	.71	.88
12-in.	42 "	.90	1.03	1.00	.90	.90	1.00	.87	.85	.80	.83	.80	1.00	.80	.695	.84	.89	1.00	1.15	1.02	.70	.75	.68	.63	1.00	.90	.72	.88
6-in.	1,840 "	.17	.27	.23	.17	.20	.17	....	.22	.15	.21	.18	.14	.13	.16	.20	.15	.22	.18	.15	.21	.18	.25	*	.17	.16	.225	.20
6-in.	3,192 "	.17	.215	.23	.14	.20	.17	....	.22	.15	.21	.18	.14	.13	.16	.20	.15	.22	.17	.15	.145	.16	.18	*	.14	.14	.185	.18
6-in.	3,192 "	.17	.19¼	.23	.14	.20	.17	....	.22	.15	.21	.18	.14	.13	.16	.20	.15	.22	.16	.15	.145	.16	.17	*	.14	.14	.185	.18
6-in.	1,596 "	.17	.19¼	.23	.14	.20	.17	....	.20	.15	.21	.18	.14	.13	.16	.20	.15	.22	.16	.15	.145	.16	.16	*	.14	.14	.185	.18
6-in.	756 "	.17	.23¼	.23	.17	.20	.17	....	.20	.15	.21	.18	.14	.13	.16	.20	.15	.22	.15	.15	.145	.17	.16	*	.14	.14	.185	.18
Catchbasins	84	19.75	28.20	22.00	16.00	35.00	20.00	16.66	24.00	22.00	27.00	25.00	22.00	18.75	18.50	24.20	22.50	25.00	19.00	21.50	19.00	23.50	17.00	23.00	21.00	17.00	22.45	20.00

* Lump bid of $2.336. ** The contract has been awarded to Nelson & Cleary.

RAILWAY.—Kansas City, Mo.—The Kansas City, Pittsburg & Gulf R. R. Co. is reported to have awarded a contract for a 70-mile extension south from the Arkansas River, near Fort Smith, Ark., to A. Monroe, of Lawrence, Kan., and S. N. Lee, of Excelsior Springs, Mo., at $4,000 a mile, which includes grading, building trestles and wooden bridges and the substructures of the steel bridges.

BRICK PAVING.—Sistersville, W. Va.—We are informed by J. Curzon that the contract for 4,800 sq. yds. of paving with brick has been awarded to Thos. & J. E. Maloney, of Bellaire, O., at 85 cts. per sq. yd., the McMahon, Porter & Co.'s brick to be used. The other bidders were as follows: Chas. Rosser, Bellaire, O.; W. J. Berry, Dillie's Bottom, O.; Geo. W. Lemmon, Wheeling, W. Va.; D. J. McVay, New Cumberland, W. Va.; Thos. & J. E. Maloney, Bellaire, O.; C. Kennedy, Parkersburg, W. Va.

CRUSHED STONE, ETC.—Baltimore, Md.—The following bids were received for furnishing crushed stone for macadamizing several streets: F. J. A. Murphy, $1.25 per cu. yd.; C. R. Diffenderfer, $1.35; Mystic Quarry Co., $1.40; George F. Mardin, $1.45; A. Weber, $1.49; J. H. Atkinson, $1.50; John G. Schwind, $1.64; McClenahan Bros., $1.64; Frank Fallon, $1.95. The bids to supply gravel for repairing Russell, Ridgely, Bayard, Warner and Haines sts. were as follows: D. Rogan, 69 cts. per cu. yd.; Wm. E. Anderson, 78 cts.; Frank Fallon, 80 cts.; B. D. Firoved, 90 cts.; Geo. Kline, $1.20; Henry Kline, $1.30.

ASPHALT PAVING.—Indianapolis, Ind.—The contract for asphalting a part of Capitol Ave., 420×50 ft., has been awarded to the Indiana Bermudez Co. The work to be done includes 2,393 sq. yds. of asphalt on Portland cement concrete, 829 ft. of stratified limestone curb, 73 ft. of granite round-corner curb, 101 ft. of marginal stone, 1 manhole, 2 catchbasins, 3 inlets, 110 ft. of 15-in. pipe drain. The Western Paving & Supply Co. bid $7.87, the Warren-Scharf Asphalt Paving Co., $7.86, and the Indiana Bermudez Co., $7.83.

STREET SWEEPING.—Indianapolis, Ind.—The contract for sweeping improved streets has been awarded to the Indianapolis Street Cleaning Co., using the new Furnas pneumatic machine, at 42 to 44 cts. per 10,000 sq. ft. for each cleaning. J. R. Kennington's bid, using sweeping machines, was 75 cts. We are informed that these figures show the decrease in cost due to the new machine.

BRIDGES AND MASONRY.—Pittsburg, Pa.—Charles Davis, County Engr., writes us that the contract for seven iron bridges was awarded May 25 to the Pittsburg Bridge Co., at a lump bid of $11,900, the prices for the several bridges being as follows: No. 1, 46½ ft. long, static load 780 lbs. per lin. ft., $1,100; No. 2, 38 ft. long, static load 750 lbs., $825; No. 3, 33 ft. long, 730 lbs., $800; No. 4, 34 ft. long, 730 lbs., $790; No. 5, 30 ft. long, 700 lbs., $750; No. 6, 43 ft. long, 770 lbs., $990; No. 7, two spans of 80 ft. each, static load 1,400 lbs. per lin. ft., $6,800. The masonry was awarded as follows: J. C. O'Connell, No. 1, at $6.88 per cu. yd.; O'Donnell & Callighin, Nos. 2, 3 and 5, at $7 per cu. yd.; Wm. Dickson, No. 4, at $6.65; No. 6, at $6.85; Driver & Ranson, No. 7, at $6.98; No. 8, stone arch bridge, 10-ft. span, at $8.48; No. 10, stone arch bridge, 12-ft. span, at $9.35; John Kindlin, No. 9, stone arch bridge, 8-ft. span, at $8.50; John Englert, No. 11, segmental stone arch bridge, 28-ft. span, at $8.45.

LEVEE WORK.—Memphis, Tenn.—Capt. C. McD. Townsend, U. S. Engineer Office, informs us that the following contracts have been awarded for 600,000 cu. yds. of levee work in the Upper Tensas levee district: Red Fork extension, sections 10, 11 and 12, to J. H. Carey, at 9.45 cts. per cu. yd.; Section 13 to Martin Jennings, at 10½ cts.; Cypress Creek to McBain & Co., at 10⅝ cts.; Lucca extension to J. H. McTighe, at 13½ cts.; Chico to Johnson & Outzen, at 10.2 cts.; above Luna to Ben Talley, at 10.9 cts.; Leland to Michael J. Roach, at 6.9 cts.; Lake Port to the Eltringham Construction Co., at 7.7 cts.; Florence to Brooks Mill, to James S. Peak, 6⅝ cts. On June 21 2,200,000 cu. yds. of work will be let in the upper and middle Tensas and Yazoo country.

STONE PAVING AND SEWER.—Chester, Pa.—James B. Campbell, Cy. Clk., writes us that the contract for paving Providence Ave., between 15th and 16th Sts., with Belgian blocks has been awarded to John Hanna, at $3.07 per sq. yd. for 6×8-in. and $2.78 for 8×12-in. blocks, the size of the blocks to be determined by the street committee. The contract for building a sewer in Third St., from Broomall to Tilghman, was awarded to William E. Riley, at $1.58 per lin. ft.; manholes, $17; inlets, $58; rock, $2 per cu. yd.

PIPE AND CASTINGS.—Brooklyn, N. Y.—The following bids were received May 29 for furnishing and delivering 8,800 lin. ft., 2,180 tons, of 48-in. pipe, 1 1-16 ins. thick, for the main between the Ridgewood pumping engine house and Spring Creek:

	Per ton of 2,240 lbs. 48-in. pipe.	Spec. als.
A. R. Whitney & Co.	$22.54	$49.00
Thos. J. McKenna	22.59	49.95
McNeal Foundry & Pipe Co.	*19.50	40.00

* $19.50 f. o. b. cars Long Island City; $20.40 f. o. b. cars Ridgewood station; $20.65 unloaded, Ridgewood station.

ASPHALT, STONE AND WOOD PAVING.—St. Paul, Minn.—The contract for paving Fourth St. with asphalt has been awarded to the Warren-Scharf Asphalt Paving Co., at $2 per sq. yd., or $31,792 for the entire work. Hennesey Bros. & Cox bid $38,700. The pavement is guaranteed for 10 years, and is said to be similar to that for which previous contracts have been awarded at $2.30 and $2.52 per sq. yd. The contract for paving Sibley St. with standard granite blocks was awarded to Frank McClellan, at $2.25 per sq. yd., total bid $5,422, which is said to be 25 cts. less per sq. yd. than previous contract for similar work. The contract for paving in St. Peter and Martin Sts. with cedar blocks on a plank foundation was awarded to Fielding & Shopley at 77 cts. per sq. yd., which is said to be 48 cts. lower than any similar contract.

PUMPING ENGINES.—Buffalo, N. Y.—The following bids were received May 29 for a 30,000,000-gallon vertical triple-expansion pumping engine:

Holly Mfg. Co.	$64,500
Lake Erie Engineering Co.	74,500
Snow Steam Pump Works	$76,875 and 78,900
Edward P. Allis Co.	78,000
Henry R. Worthington	84,750
Groshon High-Duty Pumping Engine Co.	103,000

For four boilers the bids were as follows: Riter Bros., $19,300; Lake Erie Boiler Works, $21,250 and $21,475.

WATER-WORKS.—Perkasie, Pa.—The following bids were received May 27 for constructing water-works, as advertised in Engineering News, the contract being awarded to P. Harrison & Sons; Engrs., Potter & Folwell:

Bids Received at Perkasie, Pa., May 27, for Constructing Water-Works.

Quantities.		P. H. Harrison & Sons, Newark, N. J.	O'Reilly & Nolan, Philadelphia.	H. E. Ahrens, Reading, Pa.	Lehigh Valley Const'n Co. S. Bethlehem, Pa.	O. Patterson, Baltimore, Md.	C. J. Young & Co., Philadelphia, Pa.	John B. Foley, Philadelphia, Pa.	John Shields, Philadelphia, Pa.	Mitchell & Neff, Newark, N. J.	M. P. Quinn, Pottsville, Pa.	R. D. Wood & Co., Philadelphia, Pa.	Lashbury & Anderson, Philadelphia, Pa.
Furnishing and laying:													
8-in. pipe	3,000 ft.	$0.60	$0.57½	$0.62	$0.64	$0.68	$0.61½	$0.62¼	$0.70	$0.69	$0.64	$0.67	$0.68
6-in.[1] "	3,800 "	.49	.49⅝	.51½	.50	.55	.50	.52¼	.60	.58	.52	.54	.60
6-in.[2] "	7,300 "	.45	.45	.46	.45	.47½	.45¼	.47½	.57	.54	.47	.46	.55
4-in. "	6,500 "	.34	.36	.37	.36	.42	.38	.39	.49	.42	.36	.37	.47
Specials	8,000 lbs.	.02¼	.02½	.02	.02	.02½	.03¼	.02¼	.03½	.02½	.04	.04½	.03
8-in. valves	8	16.00	15.00	15.00	20.50	20.25	19.82	16.50	20.00	20.00	20.00	18.00	21.00
6-in. "	12	10.00	9.25	9.25	14.00	14.25	14.95	10.50	14.00	13.00	15.00	14.00	15.00
4-in. "	16	7.00	6.25	6.25	8.75	8.50	9.05	6.50	9.00	8.00	9.00	8.00	10.00
8-in valve boxes	8	3.00	3.00	2.60	2.75	3.25	2.80	2.50	3.25	3.50	3.50	3.00	3.00
6-in. " "	12	3.00	3.00	2.60	2.75	3.25	2.80	2.50	3.25	3.25	3.50	3.00	3.00
4-in. " "	16	3.00	3.00	2.60	2.75	3.25	2.80	2.50	3.25	3.25	3.50	3.00	3.00
Fire hydrants	30	23.00	20.99	21.50	28.00	26.25	26.40	21.75	27.25	23.00	27.50	25.50	29.00
Rock excav., trench	100 cu. yds.	1.50	1.29	.85	3.00	2.50	.70	1.10	.95	4.00	1.75	1.85	2.50
Extra " "	50 " "	.30	.58	.25	.50	.60	.88	.55	.50	.60	.50	.55	.29
Storage reservoir:													
Clear'g, grubb'g		25.00	120.00	50.00	50.00	50.00	100.00	100.00	75.00	50.00	300.00	55.00	200.00
Earth excav.,	2,500 cu. yds.	.25	.23½	.32	.25	.20	.19	.35	.25	.27	.30	.29	.28
Rock "	50 " "	1.00	1.24	.85	1.75	.75	1.15	1.30	.80	3.50	1.50	1.50	2.00
Embankment	1,600 " "	.25	.16	.15	.35	.10	.17	.45	.05	.33	.30	.30	.45
Concrete	375 " "	5.00	5.35	5.25	4.50	5.00	6.48	4.50	4.50	6.00	4.20	4.80	6.50
Brick lining	1,944½ " "	.94½	.88	.83	.80	.70	.53	.95	.95	1.40	2.00	2.20	1.87
4-in. tile drain	300 ft.	.20	.50	.28	.20	.08	.21	.16	.25	.25	.25	.27	.40
Receiving basin:													
Clear'g, grubb'g		15.00	38.00	30.00	25.00	50.00	110.00	75.00	25.00	40.00	45.00	148.00	300.00
Excavation	900 cu. yds.	.30	.33	.32	.25	.20	.30	.40	.30	.30	.30	.30	.40
Embankment	300 " "	.25	.16	.10	.35	.10	.17	.50	.05	.36	.30	.20	.45
Clay puddle	350 " "	.40	.86	.55	.75	1.00	.35	1.80	1.00	.35	1.60	1.10	.40
Overflow mas'ry	5 " "	4.00	10.00	3.00	10.00	4.00	3.75	5.50	4.50	4.00	10.00	11.25	7.00
Total		$16,073	$16,234	$16,283	$16,634	$16,819	$17,050	$17,863	$18,645	$19,861	$19,571	$20,154	$22,296

[1] Weight, 35 lbs. [2] Weight, 30 lbs.

DAMS AND SHORE PROTECTIONS.—Rock Island, Ill.—Lieut.-Col. A. Mackenzie, U. S. Engineer Office, has recommended that the following contracts be awarded for constructing dams and shore protections, as advertised in Engineering News: Albert Kirchner, Fountain City, Wis., work between Genoa and Prairie du Chien, Wis., 25,000 cu. yds. of rock in place, at $1, and 25,000 cu. yds. of brush in place, at 14 cts. per cu.

yd.; also same amount of work between Dubuque and Clinton, Ia., at same prices; James Short, St. Charles, Mo., work between Hamburg, Ill., and Cap du Gris, Mo., 30,000 cu. yds. of rock, at 94 cts., and 30,000 cu. yds. of brush, at 15 cts. per cu. yd.; also same amount of work between Cap du Gris, Mo., and mouth of Illinois River, at 87 cts. and 10 cts., respectively, for rock and brush. The other bidders were as follows: Volney A. Bigelow, La Crosse, Wis.; Halvorson, Richards & Co., Minneapolis, Minn.; A. B. Teasdale, Cassville, Wis.; Jacob Richtman, Fountain City, Wis.; Sid. J. Truax, Hastings, Minn.; Patterson Bros., Keokuk, Ia.; A. J. Whitney, Rock Island, Ill.; Kelly & Monroe, Portsmouth, O.; H. S. Brown & T. S. Adams, Quincy, Ill.

FURNISHING AND LAYING WATER PIPE.—Harlem (P. O., Oak Park), Ill.—We have received a statement of the bids received May 25 for furnishing and laying 1,336 ft. of 4-in. hydrant connections, 15,063 ft. of 4-in. cast iron pipe, 5,644 ft. of 6-in., 6,788 ft. of 8-in., and 1,436 ft. of 12-in. pipe, with 78 hydrants and 23 valves. Bids were submitted for Eddy, Crane, Michigan Brass & Iron, Mathews, Ludlow and Galvin valves and hydrants. Engr., W. T. Griffith, 419 Chamber of Commerce Bldg., Chicago. The bids for furnishing and laying the pipe were as follows:

Bidder.	Hydrant connections, 1,332 ft.	4-in. mains, in cldg specials, 15,063 ft.	6-in. mains, in cldg specials, 5,644 ft.	8-in. mains, in cldg specials, 6,788 ft.	12-in mains, in cldg specials, 1,436 ft.	Total on pipe.
J. Healy & Son.	$0.44	$0.41	$0.61	$0.74	$1.18	$16,898
Kissack & Muir.	.38	.377	.515	.65¾	1.06	15,099
Campbell, Dennis & Co.	.46	.40	.59	.71	1.18	17,358
M. Donahue	.62	.62	.83	.83	1.34	22,571
B. A. Ward	.38	.41	.50	.65	1.25	16,121
Daniel Hardin	.46½	.43¼	.577	.69¾	1.18	16,894
I. Robinson	.41	.41	.56	.71	1.20	16,401
S. I. Pope & Co.	.43	.41	.58	.74½	1.20	16,778
J. O'Laughlin	.45	.45	.61	.73	1.17	17,429
Farley & Green.	.42	.42½	.54¼	.64¾	1.18¼	16,090
Nelson & Clarey.	.35¼	.36¼	.47	.60¼	1.01	14,101
Snyder& Williams	.47	.43	.59	.75	1.24	17,279
John H. Synon.	.37½	.36½	.50¼	.68½	1.08	15,154
Geo. C. Morgan.	.42	.38½	.51¼	.62¾	1.07¼	15,028
P. A. Weeks	.38¼	.39½	.52½	.67	1.04	15,751
C. & T. Iglehart.	.33	.33	.48½	.65	1.06	14,062
Jas. Murphy	.39	.43	.57	.71	1.19	16,736
B. Williams	.39	.39	.54	.75	1.20	16,791
C. W. Maynard.	.42	.37	.49	.64	1.00	14,656
John Healy	.35	.35	.50½	.61	1.00	14,144
C. M. Porter	.38	.37½	.51	.65	1.19	15,122
Nash & Dowdle.	.51	.52½	.59½	.71½	1.07	18,284
Castrain & McDonald	.40	.40	.52½	.627	1.01	17,189

Seckner Contracting Co., lump bid, $16,263.

ASPHALT PAVING.—Newark, N. J.—The following bids were received for paving Chestnut St., from Broad to Mulberry St., with asphalt: Barber Asphalt Paving Co., awarded contract, $2.69 per sq. yd.; New Jersey Asphalt Co., $2.72; John F. Shanley, $2.97.

BRICK PAVING.—Indianapolis, Ind.—Contracts were let May 23 for paving Clifford Ave. with brick. One section is 2,461 × 35 ft., and will have 10,537 sq. yds. of brick surface on Portland cement concrete, 4,396 ft. of stratified limestone curb, 198 ft. of granite round-corner curb, 748 ft. of marginal stone and 16 inlets. About 1,200 ft. of one side of the street lies along the U. S. Arsenal, and is difficult, if not impossible, to collect for. The bids were from $5.15 to $6.16 per lin. ft. of each side of the street, except that of C. M. Kirkpatrick, to whom the contract was awarded at $4.68. The second section is the north half of the street opposite the town of Woodruff Place, the south half being in that town. It is 1,240 × 17.5 ft., will have 2,583 sq. yds. of brick surface on Portland cement concrete, 1,135 ft. of stratified limestone curb, 94.5 ft. of granite round-corner curb, 140 ft. of marginal stone and 3 inlets. The bids on this section varied from $4.33 to $4.72, except that of the Indiana Paving Brick Co. for its standard block, to whom the contract was let at $3.87.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

LEVEE WORK.—Clarksdale, Miss.—Bids are asked until June 13 for the enlargement of levee lines. T. G. Dabney, Ch. Engr.

PASSENGER CARS.—Brooklyn, N. Y.—Bids are asked until June 10 for 12 passenger cars. C. C. Martin, Ch. Engr. New York & Brooklyn Bridge.

IRON PILES.—San Francisco, Cal.—Bids are asked until June 24 for reconstructing with iron piles the wharf at Presidio. A. S. Kimball, Deputy Q. M. Gen.

CRIB DIKE.—Wilmington, Del.—Bids are asked until July 1 for the construction of a crib dike at mouth of Mispillion River, Del. Wm. O. Smith, U. S. Agent.

HIRE OF DREDGE.—New Orleans, La.—Bids are asked until June 28 for hire of a dredge for improving Bayou Lafourche. Maj. James B. Quinn, U. S. Engr. Office.

ELEVATORS.—Washington, D. C.—Bids are asked until June 18 for one passenger and one freight elevator in the U. S. Treasury building. Wm. Martin Aiken, Supervising Arch.

HEATING AND VENTILATION.—Winnipeg, Man.—The school board wishes to correspond with firms manufacturing heating and ventilating systems. Stewart Mulvey, Secy. School Bd.

WHARF, ETC.—Southport, N. C.—Bids are asked until June 19 for erecting a wharf, buildings, etc., at the quarantine station at this place. Wm. M. Aiken, Supervising Arch., Washington, D. C.

SURVEYING, ETC.—St. Louis, Mo.—Julius Pitzman & Co. are reported to have been awarded a contract for surveying and laying out about 300 acres of land surrounding Spanish Lake. It is stated that the streets will be graded and about $100,000 worth of improvements made. S. T. Rathell, Gen. Man. Spanish Lake Improvement Co.

STREET CLEANING.—Buffalo, N. Y.—The aldermen have voted to award the contract for cleaning the streets of the city for three years to Cooper & Hopkins, Chicago, at their bid of $98,786 a year. If the councilmen concur in this action the award will probably be declared final. Cooper & Hopkins were not the lowest bidders, but we are informed that they have been doing the work for several years and have given general satisfaction.

SURVEYING.—Laramie, Wyo.—A local paper states as follows: A. P. Holmes and J. M. Hoge have contracts for the surveying of state lands during the season. Mr. Holmes has the contract for surveying a half dozen townships 30 miles north of Green River. Mr. Hoge has the contract for double that amount of work in the Teton country. They will do this work together, and will leave Laramie about June 1 to begin operations. Gilmore & Loback will also be in the field in June completing their contract.

HARBOR IMPROVEMENTS, ETC.—Mexico, Mex.—A press report from this city states that Samuel Hermanos, 54 Broad St., New York, has been awarded a contract by the Mexican government for the furnishing of $2,000,000 worth of rolling stock and equipment for the Tehuantepec R. R., including bridges, machine shops, tugs, tug lighters for the harbors, and steamships for lighthouse service. In addition to the equipment contract the firm of Samuel Hermanos is negotiating for the improvement of the terminal harbors at Coatzacoalcos and Salina Cruz.

INDUSTRIAL NOTES.

THE KEYSTONE IRON WORKS, of Reading, Pa., is reported as intending to resume work on June 10, after having been shut down for three years.

THE INDUSTRIAL WORKS, Bay City, Mich., have a contract for a 70-ton electric traveling crane for Jones & Laughlin's new open-hearth steel plant at Pittsburg, Pa.

SMITH & HANFIELD, of New York, general contractors, who have the contract for grading the parade ground at Van Cortlandt park, are said to have had a receiver appointed.

THE HALL SIGNAL CO., of New York, N. Y., has a contract to apply the Hall automatic signal system on 15 miles of double track of the Michigan Central R. R., near Detroit.

THE BUFFALO BRASS WORKS, of Depew, N. Y., was destroyed by fire May 23, involving a loss of about $25,000. The works manufactured principally brasses for car journal boxes.

HOOPES & TOWNSEND, of Philadelphia, Pa., manufacturers of bolts, nuts, washers, rivets, lag screws, etc., have appointed Jno. F. Lovejoy, of 9 Havemeyer Building, New York city, as agent for the sale of their manufactures.

J. S. MUNDY, of Jersey City, N. J., is building ten 60- HP. double cylinder, double-drum, coal-hoisting engines for the Ohio Coal Co., Duluth, Minn. He is also busy on work for the Johnson Co., of Johnstown, Pa., and on a number of smaller contracts for hoisting engines, boilers, etc.

THE WESTERN FILTER CO., of St. Louis, Mo., has just completed a 500,000-gallon filtering plant for the Murphysboro, Ill., water-works, making the fifth water-works plant it has equipped. It has also a complete 500,000-gallon plant for Johnson & Johnson, of New Brunswick, N. J.

THE YOUNGSTOWN BRIDGE CO, of Youngstown, O, has been awarded the contract for four spans of a double track bridge for the Lake Shore & Michigan Southern Ry., to be constructed entirely of soft steel. It has also been awarded the contract for the structural work of an oil store house in New York.

THE UNION BRIDGE CO., of New York city, is now composed of Charles Macdonald and Andrew Onderdonk. The former partnership, consisting of Charles Macdonald, of New York; Charles S. Maurice, of Athens, Pa., and Edmund Hayes, of Buffalo, N. Y., has been dissolved, and the two last-named members have retired.

THE AMERICAN BRIDGE WORKS, Chicago, has been awarded the contract for furnishing the steel work (1,700 tons) for the new shops of the Illinois Central R. R., to be located at Burnside, and for putting in six crossings for the track elevation work in connection with the Lake Shore & Michigan Southern and the Chicago, Rock Island & Pacific railways.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has just completed a new boiler house roof for the Stanley Works, at New Britain, Conn., and has designed the large three-story building which the Union Metallic Cartridge Co. is putting up at Bridgeport, Conn. The entire framework of this building will be of steel, with brick walls, and all appliances for making the construction as nearly fireproof as possible.

THE HEINE SAFETY BOILER CO., of St. Louis, Mo., has received a bonus from the Edison Illuminating Co., of St. Louis, the boilers having exceeded the guaranteed evaporation of 8 lbs. of water per pound of coal. The guarantee was also for 7 lbs. of water per hour per sq. ft. of heating surface. The results gave 8.335 lbs. of water per pound of coal, and 7.258 lbs. of water per sq. ft. of heating surface. The Heine company has built 12 boilers, aggregating 4,500 HP., for the Edison Illuminating Co.

THE DETRICK SUPPLY CO., St. Louis, Mo., has succeeded the Ripley-Detrick Supply Co., and will continue in the same line of business as general jobbers in all kinds of water-works supplies. The new firm has also absorbed the Albert Webb Supply Co., so that a general line of plumbing supplies will be added to its business. The new company is pushing the new Corey compression fire hydrant and reports that it has been adopted in about 20 different places. The officers are: Pres., D. F. Kaime; Vice-Pres., A. Webb.; Secy. and Treas., G. F. Detrick.

THE COOK WELL CO., of St. Louis, Mo., reports a decided improvement in its line of business. It has recently been awarded contracts as follows: Putting in a complete water supply for the Kansas City (Mo.) Stock Yards Co., of 1,500,000 gallons daily capacity, about 6 wells will be sunk; completely rebuilding the water supply system of Downs, Kan.; increasing the supply of Three Rivers, Mich.; building a new pumping station for the Chicago & Eastern Illinois R. R., at Cuyoga, Ind.; new water supply for Nelson, Morris & Co., at East St. Louis, Ill.; a 10-in. well, 165 ft. deep, at Hastings, Neb., from which water will be pumped by a Pohle air lift pump (for which this company is the Western agent), and putting down the fourth 10-in. well at Bloomington, Ill., which is to increase the daily supply to 3,500,000 gallons. Pres., H. F. Cook.

THE PLEUGER & HENGER MFG CO., of St. Louis, Mo., was awarded the contract, on May 17, for furnishing the city of St. Louis with 475 fire hydrants. This firm is the manufacturer of the "National" fire hydrant, of which about 10,000 are in use. It also manufactures a general line of water-works supplies, and claims to manufacture a greater variety of yard hydrants than any other company. The "National valve box" is also in extensive use. In addition to its regular lawn sprinklers, the "Cactus," "Imperial" and "Japanese," it is now putting a new "Park" lawn sprinkler on the market, which has already been adopted by the parks in Chicago and elsewhere. It is so constructed that it will throw either a half or full circle stream. Pres. and Gen. Man., C. L. Pleuger; Secy. and Treas., H. W Henger; Supt. B. H. Sanders.

WATER-WORKS SUPPLIES.—The following exhibits were to be seen at the fifteenth annual convention of the American Water-Works Association, held at Atlanta, May 28, 29 and 30:

Valves and Hydrants.—The Michigan Brass & Iron Co., Detroit, Mich.; Crane Co., Chicago, Ill.

Pipe Cutting Machines.—B. C. Smith, 275 Pearl St., New York.

Pipe Tapping Machines.—Anthony P. Smith, Newark, N. J.; Brass & Iron Works, Fostoria, O.; Payne Tapping Machine Co., Fostoria, O.

Pipe Jointer.—Thos. Watkins, Johnstown, Pa.

Water-Works Tools and Fittings.—H. Mueller Mfg. Co., Decatur, Ill.

Lead-lined Pipe.—Lead-Lined Pipe Co., Wakefield, Mass.

Meters.—Thomson Meter Co., Brooklyn; Henry R. Worthington, N. Y.; Hersey Mfg. Co., South Boston, Mass.; National Meter Co., New York; Fuel Gas & Mfg. Co., Pittsburg, Pa.; Neptune Meter Co., New York; Union Meter Co., Worcester, Mass.

NEW COMPANIES.—Union Paving Co., Los Angeles, Cal.; $50,000; F. M. French, Sidney B. Reese and Arthur S. Bent.

Malloy Car Coupling Co., Portland, Ore., $400,000; John J. Malloy, R. W. Baxter and C. P. Bass.

American Rail Joint & Mfg. Co., Cleveland, O.; $30,000; railway supplies; Thos. L. Johnson, W. T. Black, and D. C. True.

Big Birch River Lumber, Coal, Oil & Gas Co., Sutton, W. Va.; $200,000, with $250 paid in; J. S. Hyer, E. S. Bland and J. M. Morrison.

Washington Undulating Motor Pump & Water Power Co., Tacoma, Wash.; $150,000; G. W. Van Fossen, J. W. O'Keefe and A. N. Hamilton.

Western Railway Equipment Co., St. Louis, Mo.; $300,000; car couplings and brake gear; G. W. Taussig, E. S. Barreiras and H. L. Magee.

Layton Ferry Co., Layton Station, Pa.; $5,000; to operate a ferry across the Youghiogheny River; Treas., George B. Motheral, Pittsburg, Pa.

General Heating Co., Philadelphia, Pa.; $50,000, with $5,000 paid in; heating apparatus; Treas., Pedro G. Salom, 926 Drexel Building, Philadelphia, Pa.

Ingot Machine Co., Newark, N. J.; $300,000, with $1,000 paid in; machinery for casting steel and other ingots; Benjamin Atha, John Illingworth and Robert H. Illingworth.

Ross Improved Furnace Walls & Boiler Setting Co., Mount Holly, N. J.; $25,000, with $5,000 paid in; John Ross and Henry K. Vandusen, of Philadelphia, Pa.; Charles E. Merritt, Mount Holly, N. J.

Delta Construction Co., New York, N. Y.; grain elevators, warehouses, docks, etc.; $18,000; John L. Nisbet, Yonkers, N. Y.; Edson Pearsall, Brooklyn, N. Y., and Austin M. Poole, New York, N. Y.

AHEAD, AS USUAL.

Last week this paper went to press Tuesday and was mailed on Wednesday night, yet it contained a telegraphic report of the Tuesday's proceedings of the annual convention of the American Water Works Association, at Atlanta, and also several of the papers read at the convention.

ENGINEERING NEWS PRINTS MORE reliable news items, a larger number of proposal advertisements, and is much more extensively read by contractors and manufacturers of contractors' supplies than any other paper in America. These facts should be borne in mind. They may save you or your city large sums of money on contracts.

RAILWAY WORK

noted in this paper is usually awarded to reliable contractors at economical prices. Railway officials are invited to avail themselves of our columns to secure competition for new equipment or construction. We ask especially that early notice of all projected new work be sent us.

RECEIVED TOO LATE.

Seven proposal advertisements were received too late for insertion in our issue of last week. The first pages of Engineering News go to press on Tuesday of each week, and the last pages on Wednesday afternoon, but if a holiday occurs on Wednesday or Thursday of any week, this paper usually goes to press that week one day earlier than usual. Readers should bear these facts in mind. We are unable to print news items or advertisements received too late; the senders of the items fail to have their work given the publicity they had intended, and many of our readers are thus kept in ignorance of the work. Send us all the items you can, and send them as soon as possible.